MARCH, 1959

TRAFFIC ENGINEERING

INSTITUTE OF TRAFFIC ENGINEERS
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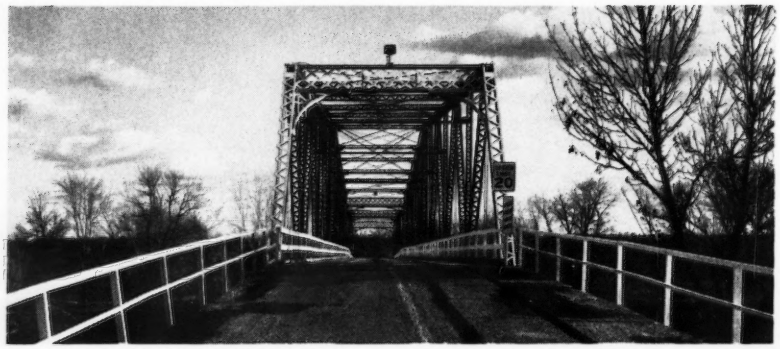
How to make hazards stand out white by day—bright by night



See how new White "Codit" Liquid stands out on the approach rails, bridge facing, and bridge rails in this photograph taken in full daylight. One application actually lasts up to two years.

Have you ever come upon a poorly delineated curve and then discovered half way through it that you were going too fast? Or have you ever found yourself in a tight squeeze on a bridge because you thought it was shorter than it actually was?

These are problems all drivers face—problems of unknown length. At night, particularly, they can be dangerous.

"Codit" Reflective Liquid can help solve these problems—by introducing a safety factor we choose to call "length delineation." The length of a bridge, a curve, an underpass can be shown at night by reflectorizing these hazards with effective, economical "Codit" Liquid that sprays or brushes on . . . just like paint!

New, White "Codit" Liquid

Now there is a new "Codit" Liquid that provides length delineation both by day and by night. It has all the advantages of our regular "Codit" Liquid—plus extra daytime visibility. It's *white* by day—and reflects *bright white* at night.

You still get wide angle reflectivity that can be seen from any angle of approach. Because "Codit" Liquid contains millions of reflex-reflectors, it catches approaching headlight beams and directs the gathered light right back to the source. The driver sees a warning that is 40 to 50 times brighter than white paint at night.

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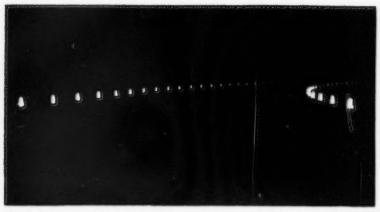
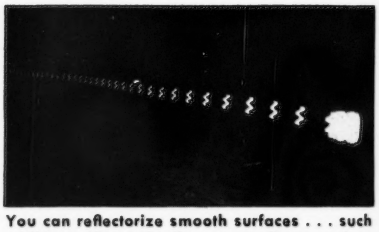
Remarkably rugged "Codit" Liquid can be applied easily with spray gun, tank type spray equipment, or with a brush. You just spray it on or brush it on quickly in one step...it dries in minutes . . . and you've finished the whole reflectorization job. A little goes a long way . . . the cost is low . . . less than 17¢ per square foot of coverage.

You can get complete information on this versatile hazard marking material from your 3M representative. Or you can write to 3M Company, Dept. GS-39, St. Paul 6, Minnesota.



There's no doubt about the length or angle of this curve . . . its full length is distinctly delineated by "Codit" Liquid applied to each guard post.



You can reflectorize smooth surfaces . . . such as this steel guard rail . . . as well as rough or porous surfaces, with "Codit" Liquid.

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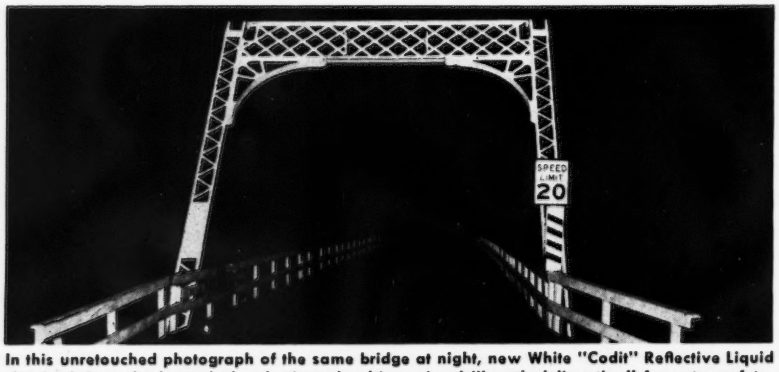

In this unretouched photograph of the same bridge at night, new White "Codit" Reflective Liquid clearly defines the hazard ahead, gives the driver visual "length delineation" for extra safety.

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REFLECTIVE LIQUID

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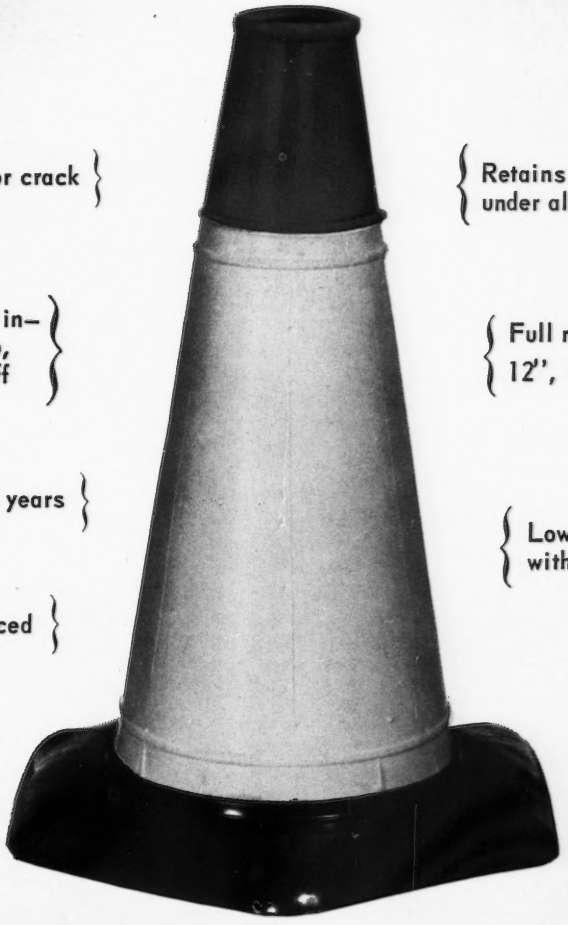

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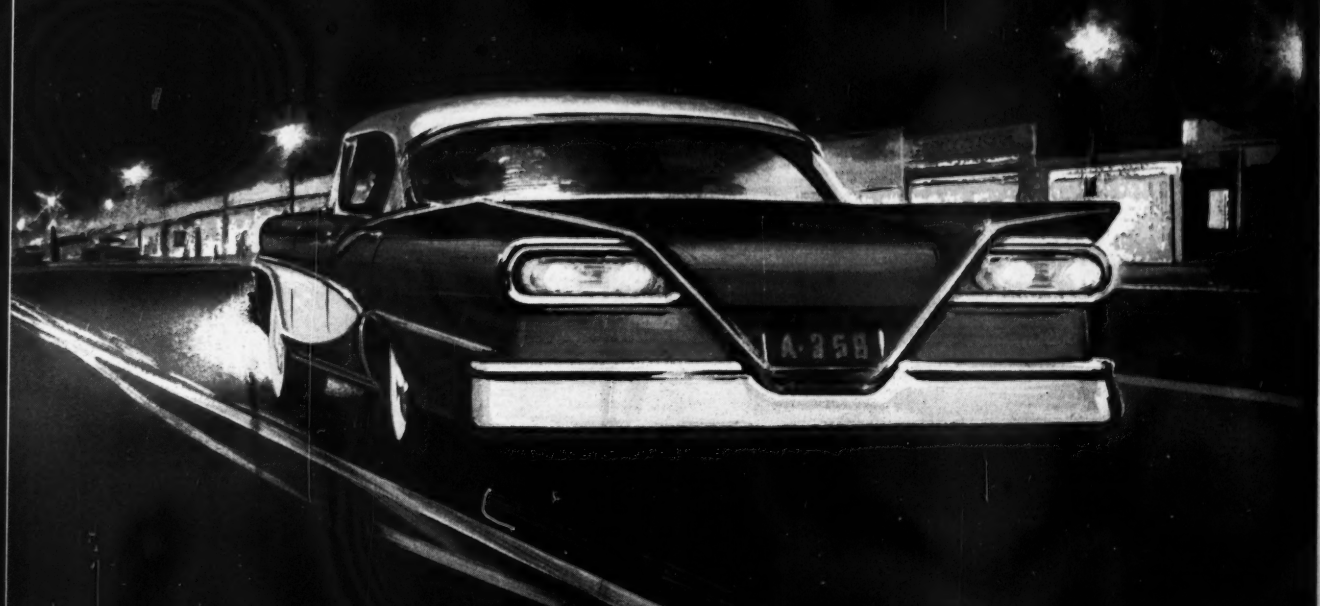

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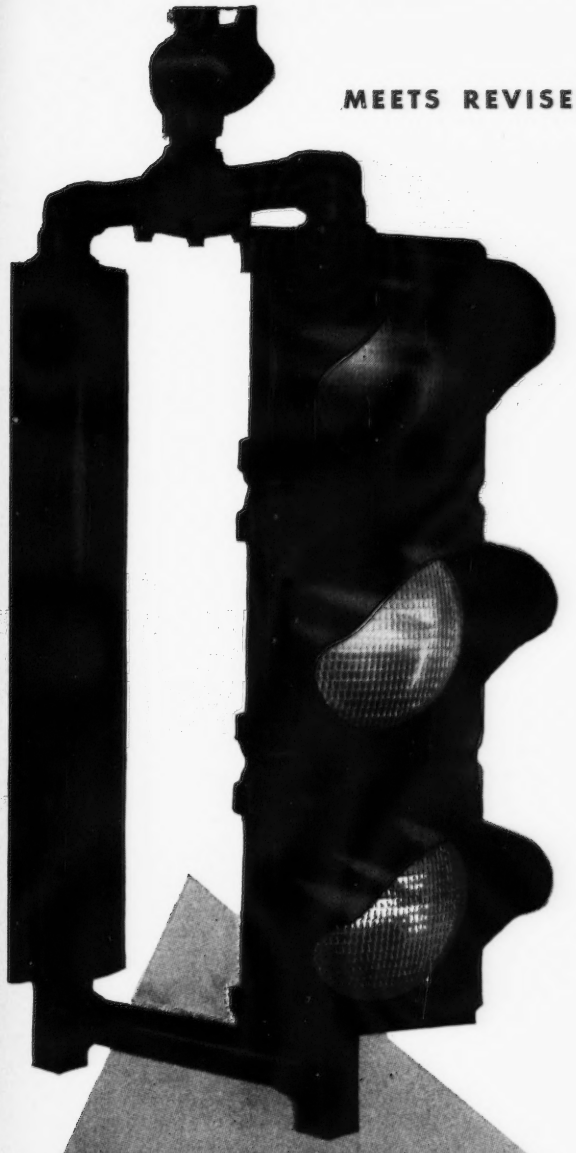

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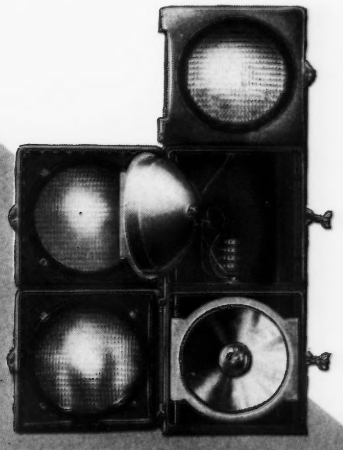

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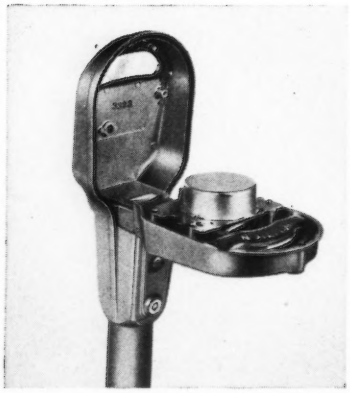

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OFFICIAL PUBLICATION OF THE INSTITUTE OF TRAFFIC ENGINEERS

Vol. 29 MARCH, 1959 Number 6

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COVER: "Safety rest areas" as authorized for the Interstate Highway System will be marked with signs like this one in Ohio. —Photo Courtesy Ohio Department of Highways.

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MUNICIPALITY

FULL ADDRESS

Frankly Speaking . . .

During the Highway Research Board meeting in Washington in January, members of the Yale Bureau class were luncheon guests of the Automotive Safety Foundation. One of the head-table guests, Federal Highway Administrator Bertram D. Tallamy, gave the group some particularly important advice, which is reprinted here:

I CONGRATULATE YOU gentlemen on your vision and determination in deciding to take a post graduate course in traffic engineering. This is a great field today and one which holds unlimited potentialities. It's a real credit to you to have recognized the fine opportunities it affords for devoted public service and personal satisfaction as well as a good, respected living for you and your families.

The new highways we have been building in recent years give a preview of the fine things which are sure to come from sound highway traffic engineering.

For example, fatalities have been cut on some of our modern highways to less than one per 100 million miles of travel. To take one outstanding example, on the New York State Thruway last year, the rate was 0.88 per 100 million miles, with a total of nearly two billion miles traveled over more than 500 miles of express highway.

These low rates, and substantial savings in time and property damage, can be still further reduced as a result of even more advanced design and improvement in maintenance and operation methods.

You will note the opportunities which are before you in metropolitan areas. I am certain that the billions upon billions of dollars invested in metropolitan streets and thoroughfares can be put to still further beneficial use. For example, great potential exists in the coordination of the electronic traffic volume forecasting and automatic signing for traffic route selections. The use of one-way street operation on a semi-express highway basis during peak directional traffic flow periods is another significant trend. Unquestionably, much more directional traffic capacity can be obtained from a combination of these existing and potential facilities, especially when combined with the reduction of cross traffic friction which can be brought about by the construction of overpasses or underpasses at critical intersections. It's up to you and all of us to realize the very maximum possible from these billions upon billions of dollars invested in the metropolitan thoroughfare plant.

The opportunities are as limitless in the field of preserving and restoring — yes, enhancing — public and private real estate, social and economic values, in these same urban areas. To get the most out of our great urban highway program, we recognize that there must be a close coordination of the plans for the redevelopment or extension of the many functions of urban life with the major thoroughfare plan for the metropolitan area.

Many States have designated urban arterial highway planning units or staffs assigned to such basic considerations in connection with their urban highway work. California, Missouri, Alabama, Illinois and New York, are numbered among the States which have made big strides in this area. The Bureau of Public Roads has recently established a new Division in its Office of Engineering to deal solely with this fundamental problem.

All of these desirable trends create limitless horizons for you and others who have chosen traffic engineering professions and who have the desire to study and learn all that can be learned as a prologue to future progress.

I can only suggest to you that in advancing toward your objective, there are three personal traits which I consider to be essential. The first, I am sure, you will all recognize as being vital to your success. It is integrity. Without it you cannot advance at all. I don't just mean honesty in the usual sense, but mental honesty as well. Having chosen a difficult but essential public service, you will be subjected to all sorts of pressures and you will have to make your decisions based on facts. There will be many of them and they will have to be arranged and weighed with honest care.

My next point if I were to advise you on how to advance in your chosen profession, I am sure may surprise you, but it is based on many years of engineering practice and administration. This point is personality. If you are going to succeed you must have good personality—people must like to work with you and for you. Your employer and the general public must have confidence in you; they must want you to take part in their conferences and discussions relating to existing and new ideas. A good personality is born in many, in others it's acquired. Regardless of how you come by it, it is essential. I have seen many outstanding engineers and scientists, men of great technical ability, who never reached the top because of a poor personality. I don't mean that you have to be an apple polisher, but you must be able to get along with people under all sorts of conditions.

The third point has to do with knowledge. You must know your subject inside and out and this point I'm sure you recognize, since you have already chosen to take a post graduate course in your chosen profession. This is all to the good.

In closing, I should again like to point out the limitless horizons in the field of traffic engineering. Through better operation of existing facilities and in the design and operation of those to come, you have the opportunity to save lives and untold human misery. Moreover, you hold in your hands the key to almost unimaginable new economic, social and recreational opportunities for all.

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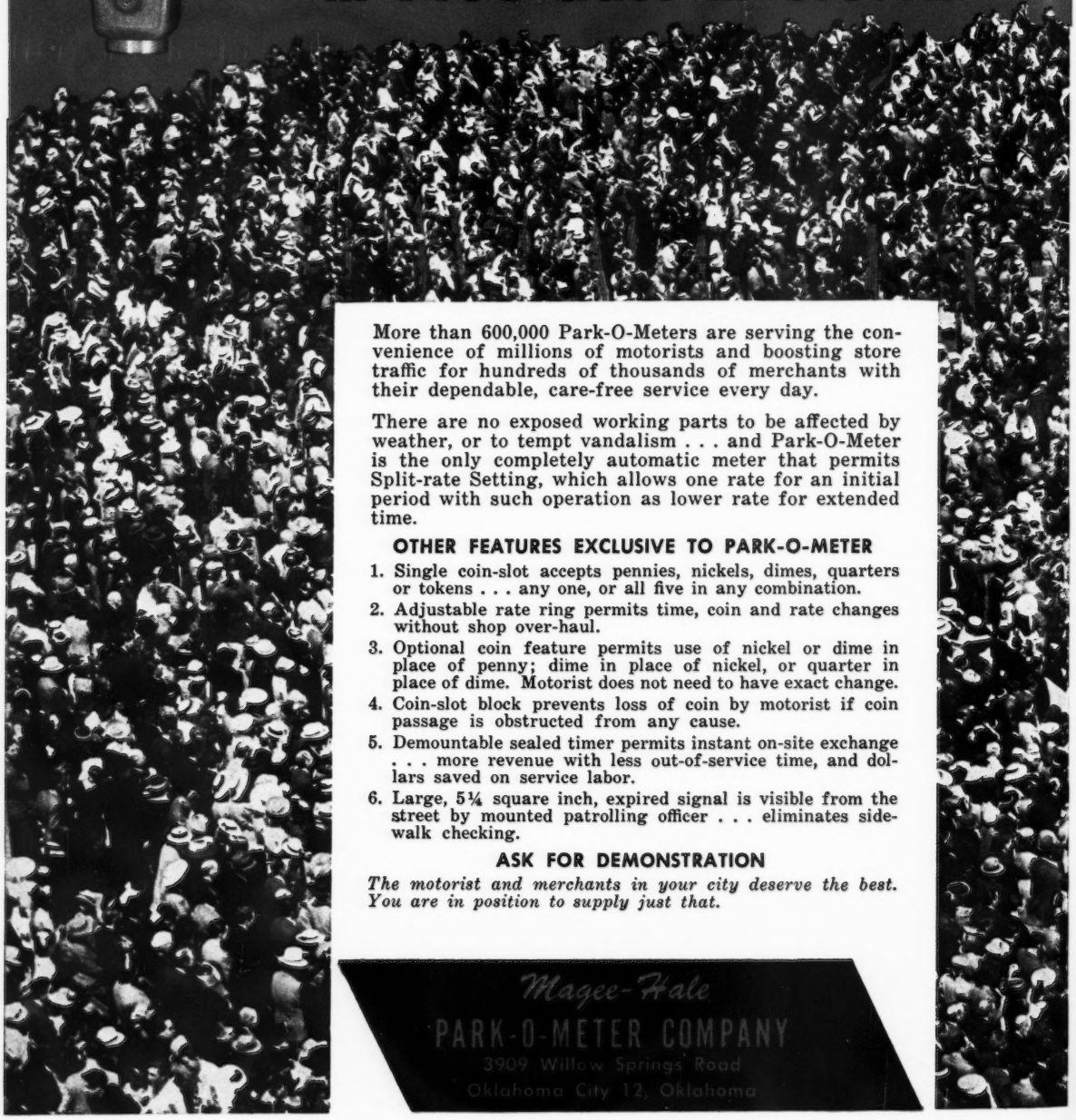
dependability is proved millions of times daily in 1400 cities in U.S.A.



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Intersection Capacity

By J. M. Bayley
B.C.E., A.M.I.E. (AUST.) A.M.I.T.E. (U.S.)
Traffic Engineer, Melbourne, Australia

In urban areas the problems encountered in moving traffic along any street and through intersections are vastly different from those problems usually found in rural areas where virtually the only problem is the interference to traffic created by the cross movement of vehicles.

A street as regards the amount of traffic it carries has many times been likened to a pipe line. Just as a six inch water pipe will not carry more than a certain amount of water, so a street will only carry a certain volume of traffic, the upper limit being determined by the maximum rate of lane volume discharge, the number of available lanes and the presence or absence of intersections. In urban areas, because of the varying conditions, control must be exercised at the bulk of the intersections. This control can be either manual or signal for the peak periods or all day depending on local circumstances and politics.

The volume of traffic passing through an intersection is very definitely limited by a number of factors and in this paper it is proposed to discuss a few of these factors in the light of

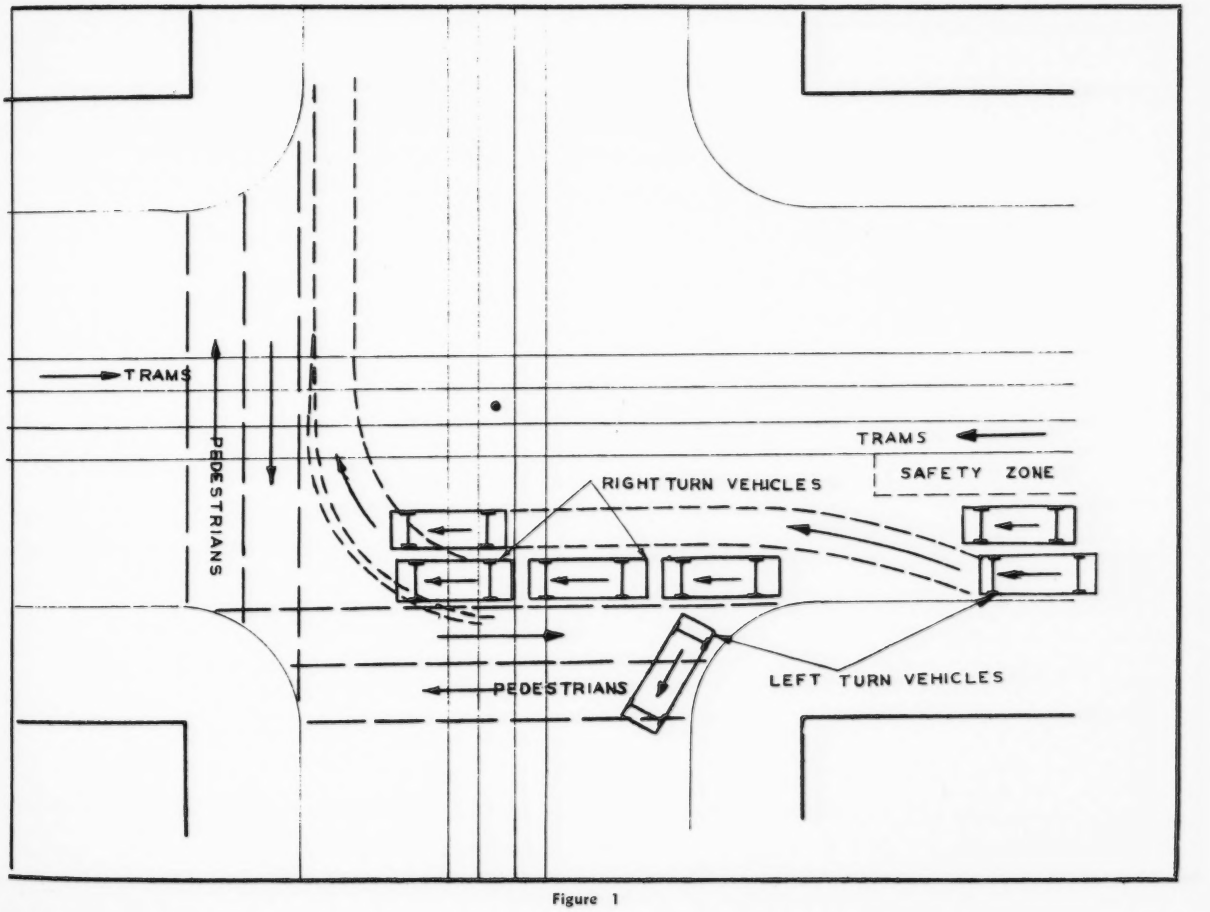

Figure 1

Extracts of papers delivered to —
(i) United Nations Economic Commission for Asia and the Far East.
Inland Transport Commisison.
Seminar on Engineering and Traffic Aspects of Highway Safety Tokyo Japan May 1957.
(ii) Institution of Engineers Australia, Melbourne Division, September 1958.

TABLE I

RECORDED MAXIMUM VOLUMES

VARIOUS INTERSECTIONS.

Site	Recorded Vol. Per ½ Hour	Green Time Per ½ Hour	Headway		Vol. Per ½ Hour Green Time	Road Width	Vol. Per 1 Hour Green Per 10' Lane	Hway. Capacity Manual	Remarks
			Full Approach Leg	Per Lane					
1	910	780	0.86	1.72	2100	17.5'	2400	703	No Peds. Flat Grade. Mainly Turning Traffic.
2	1464	790	0.54	1.6	3330	28'	2380	638	No Peds. Flat Grade. Channelized.
3	1020	1125	1.1	2.2	1630	17.5'	1860	760	Heavy Peds. Flat Grade. Central City Area. Trams.
4	370	495	1.34	2.68	1340	17.5'	1530	760	" " " " " ."
5	1362	1170	0.86	2.6	2100	30'	1400	638	No Peds. Flat Grade. Channelized.
6	340	450	1.32	2.64	1360	20'	1360	685	Heavy Peds. Flat Grade. Central City. Trams.
7	656	900	1.36	2.7	1320	20'	1320	703	Few Peds. Flat Grade. Outer Area.
8	680	790	1.16	2.3	1540	24'	1280	638	No Ped. Flat Grade. Channelized.
9	1294	1180	0.91	2.7	1980	33'	1200	638	Few Peds. Flat Grade. Channelized.
10	630	875	1.38	2.76	1300	22'	1180	638	Heavy Peds. Down Grade. City Area. Centre Parking.
11	730	830	1.14	3.42	1580	27'	1170	638	No Peds. Flat Grade. Channelized.
12	905	1350	1.5	3.0	1200	21'	1140	685	Few Peds. Flat Grade. Heavy Turning. Trams.
13	620	840	1.36	2.72	1330	24'	1100	685	Few Peds. Flat Grade. Change In Street Width. Trams.
14	504	700	1.37	2.74	1310	24'	1090	685	Few Peds. Up Grade. City Area. Trams.
15	490	650	1.32	2.64	1360	25'	1090	685	Average Ped. Flat Grade. City Area. Trams.
16	490	675	1.38	2.76	1300	24'	1080	685	Heavy Peds. Flat Grade. Central City. Heavy Comm.Trams
17	571	800	1.4	2.8	1280	24'	1070	638	No Peds. Flat Grade. Outer Area. Southern Approach.
18	541	870	1.6	3.2	1120	24'	930	638	Few Peds. Up Grade. Outer Area. Southern Approach.
19	420	780	1.85	3.7	980	22'	900	703	Average Ped. Up Grade. City Area. Central Parking.
20	369	850	2.3	4.6	785	17.5'	895	760	Average Peds. Flat Grade. Central City. Trams.

practical figures obtained from field surveys in Melbourne, Victoria, Australia. The figures we obtained are to be used for further detailed studies, but it has been apparent that certain general trends are present and it is those trends that are discussed.

To draw comparisons only intersection approaches that are operating under full capacity during the hours of observation were included in the analysis.

When capacity is mentioned it is taken to be the maximum volume of traffic that can pass through the intersection approach under the prevailing conditions with a continual backlog of waiting vehicles, i.e. possible capacity.

Local Conditions

The main study of the intersection factors was carried out within the central business district. The street widths are 99 feet building line to building line and the actual road width available for vehicular traffic varies from 63 to 75 feet. Most streets carry streetcars and these occupy the center 19 feet of the streets. At all the intersections safety zones are placed for safety of pedestrian loading operations—thus the street is further reduced by an additional 5 to 6 feet on each approach. All intersection approaches are relatively flat.

The following are the major points of Victorian Road Law, which should be borne in mind.

Vehicles in Victoria are required to keep to the left hand side of the road, must pass to the left of safety zones and must not obstruct the passage of streetcars. Two sets of right hand turns are in force.

At the five major city intersections (where streetcars intersect) vehicles must proceed along the left hand side of the road, wait for the opposing signal to turn green and then complete the turn. This turn is in force where the bulk of the following data applies. At all other Victorian intersections vehicles move to the center of the road and complete the turn on the cross traffic red signal (when opposing traffic is clear) and executing the turn "diamond" fashion.

Fig. 1 indicates the situation where both left and right turns are executed from the same side of the approach street.

Intersection Capacity General Comments

Table 1 gives the actual half hour road widths and vehicles per 10 feet width per hour of green for 20 intersections within the city. An examination of this table shows several interesting points. At eight of these intersection approaches the vehicles carried per ten feet per hour of green exceed the basic capacity of an isolated signalized intersection of 1,250 vehicles (as indicated in the Highway Capacity Manual published by the Bureau of Public Roads). Four of the approaches have average headways less than the average of 2.4, in two cases almost 25 per cent less than the average. These intersections are operating during the peak, under absolute saturation and delays of 2½ to 5 min. are experienced by every vehicle approaching the intersection. This encourages vehicles to move closer together than under less uncomfortable and undesirable conditions. Other factors contributing to this lower headway would be smaller vehicles (both in length and width), narrow lanes which are common place rather than the exception and the presence of preceding amber in the signal system. It would appear that the average headway in Melbourne under absolute peak conditions would be closer to 2.25 secs. and the basic capacity for an isolated intersection could have an average headway of 1.5 seconds, i.e. 2,000 veh/10 ft./hour green.

A further point to note is that road widths are far from ideal in two cases; only 8 to 9 feet lanes are available with high curbs.

Intersection Capacity Factors

Four factors generally considered as affecting intersection capacity are:—

(a) Inclement Weather.

(b) Pedestrian Interference.
(c) Turning Movements.
(d) Signal sequence.

(a) *Inclement Weather*

The major type of inclement weather found is wet weather in varying degrees from light mists to heavy torrential downpours. Snow and icy conditions are totally absent. Inclement weather is often quoted as a factor in lowering the capacity of a street or intersection and casual observations on wet days would indicate that traffic does move slower and more erratically and in general traffic appears to develop different characteristics than in dry conditions. However, studies have shown that the mere presence of bad weather does not appear to have a drastic effect on the volumes of traffic carried, observations have in effect shown little alteration. At 14 of the 15 intersections compared on wet and dry days the volumes dropped by about 2½ to 5 per cent over a 12 hour period, whereas at the remaining intersection the volume actually increased by 10 per cent over the same period. On the basis of existing figures the trend on wet days would appear to be a slight decrease in volume as compared with dry days. The decrease could be of the order of 5 per cent.

(b) *Pedestrian Interference*

Extensive delays are experienced at intersections carrying large volumes of pedestrians and the presence of pedestrians can materially affect the capacity of an intersection in two ways.

(i) Pedestrian stragglers clearing the intersection prevent vehicles from moving off from the stop line when the green signal indication appears for them.

(ii) Pedestrians hinder vehicles turning left; this causes delays and a relatively high percentage of vehicles approaching in the curb lane are forced to stop or move to the outside lane in order to pass through the intersection. The total effect of left turn vehicles is also dependent on whether vehicles turn singly or several at a time.

Two methods have been adopted in an attempt to increase the intersection capacity by removal of pedestrian interferences. One method involved the "Scramble" system or the inclusion of a separate pedestrian phase within the signal cycle. The other method used the separate pedestrian signals where pedestrians are controlled by a separate light system designed specifically to give the intersection a pedestrian clearing period prior to vehicles moving off with their green signal.

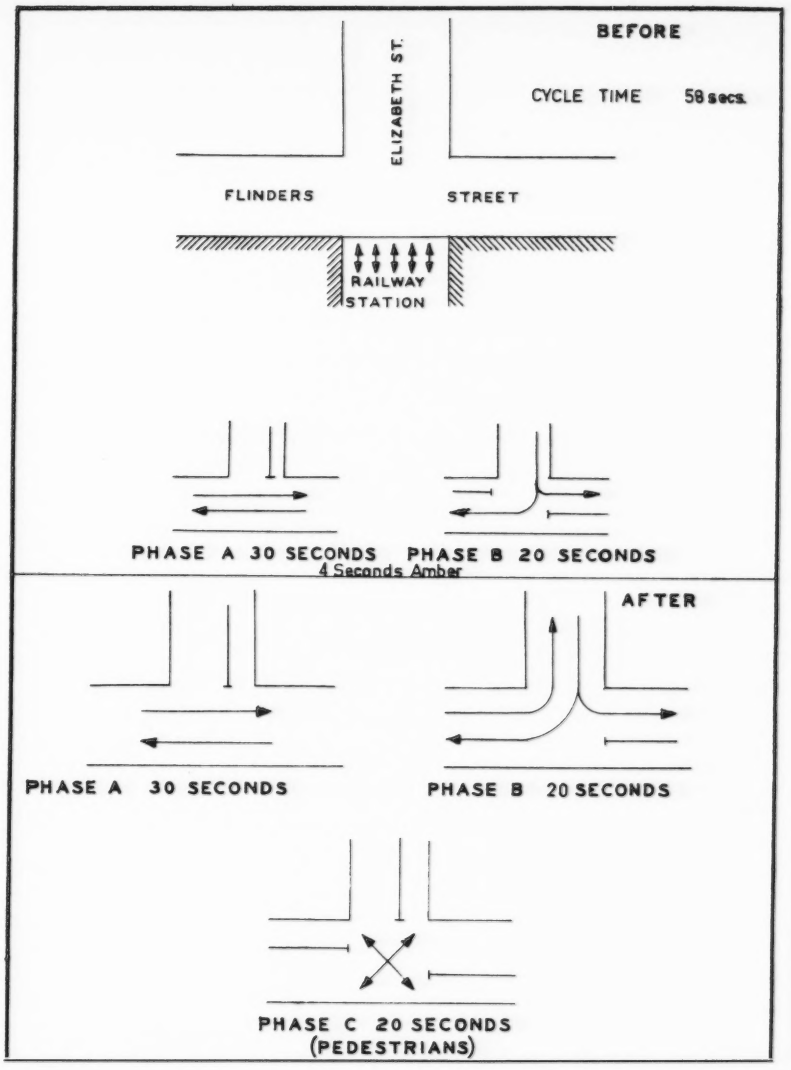

Figure 2
CYCLE TIME 88 seconds — A & B Phase 4 secs. Amber — C PHASE 10 secs. Clearing Period

Under the first method pedestrians can use the intersection as they desire since vehicles are held in four directions, whilst in the other method the pedestrians are given the same crossing time but less pedestrians are permitted to leave the curb.

Scramble System

This system was instituted at the corner of Flinders and Elizabeth Streets—a high pedestrian and vehicular T-shaped intersection. The main purpose was to obviate interference between pedestrians and vehicles which had been causing serious delays and congestion.

A new signal unit (entirely new to Australia) using neon Walk and Don't Walk legend and manufactured in the City Council Workshops was used in the experiment.

The previous signal control was a fixed time cycle, 58 seconds with 30 seconds to Flinders Street and 20 seconds to Elizabeth Street (including a 4 second amber period to both streets.) Under the revised plan the total cycle time was increased to 88 seconds, 30 seconds Flinders Street, 20 seconds Elizabeth Street and a 20 second pedestrian phase. The pedestrian phase is a 20 second Walk period and a 10

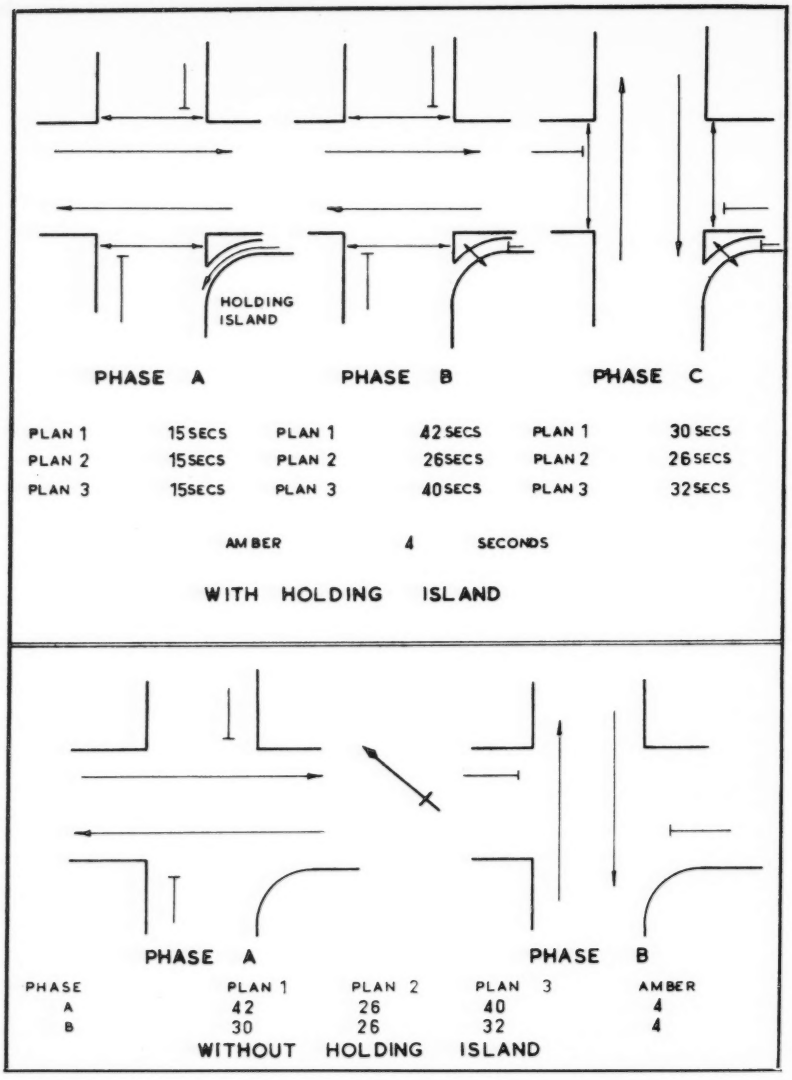

Figure 3
PLAN CHANGE TIMES

PLAN 1— 7 A.M.-10 A.M. PLAN 1—7 P.M.-8:15 P.M.
PLAN 2—10 A.M.- 4 P.M. PLAN 2—8:15 P.M.-10:30 P.M.
PLAN 3— 4 P.M.- 7 P.M. PLAN 3—10:30 P.M.-12:00 Midnight
ISOLATED WORKING MIDNIGHT-7 A.M.

second clearing period which illuminates Don't Walk. This in effect gave less cycles per hour and reduced the total time per hour available for vehicular traffic, a reduction of 35 per cent green time to vehicles. Extensive before and after studies showed that the total vehicular volume passing through the intersection has slightly increased despite the heavy decreases in allowable vehicle green time. The peak directional flows have all shown increases from 3 to 25 per cent. Other facts shown up by the studies are that the pedestrian volume crossing the intersection increased roughly 11 per cent in the peak hour (despite the 75 per cent reduction in green time given to the pedestrians) and the time taken for vehicles to actually cross the intersection was reduced by 10 to 40 per cent depending on the direction.

The 10 second clearing period had a marked effect on the clearing period of the intersection prior to vehicles receiving the green signal. The number of pedestrians still on the roadway when waiting vehicles received the green signal has been reduced by 23 per cent in the morning peak and 60 per cent in the evening peak.

The average headways of vehicles turning left through pedestrians under the old system showed a large decrease when pedestrians were removed. In off-peak hours minimum average vehicle headways of left turning vehicles dropped from 5.65 seconds to 3.26 seconds. During peak hours the reduction in headways was just as great, from 7.5 to 4.7 seconds.

On the basis of actual green time available for vehicular flow before and after the removal of pedestrian vehicular conflict it would appear that the intersection capacity has been increased by approximately 70 per cent. Under peak conditions, the minimum headway of vehicles turning left could be 3.25 seconds on flat grades.

Exclusive Turning Phase

At the intersection of Flinders and Swanston Streets a special pedestrian "holding" island was introduced to give a left turn without the pedestrian vehicle interference. This intersection has the heaviest pedestrian traffic in the city and during a 12 hour day approximately 185,000 pedestrians and 45,000 vehicles utilize the area which is flanked on the south side by the main metropolitan railway station. The bulk of the pedestrians use the western side of the intersection thus causing considerable delay to left turning vehicles. In the peak periods owing to this heavy pedestrian flow the left turns are banned. The signal system in Swanston Street is such that it provides three plans of operation throughout the day. The timings and hours of operation are indicated on Figure 3. Under the new system the basic phases remained the same, but an overlap phase of 15 seconds was introduced into cycle to give this exclusive turn for a portion of Swanston Street phase. The small holding island provided storage for pedestrians to wait prior to receiving the next green signal.

As well as providing a turn which under the old system was impossible, after-studies revealed that although the total off peak green right-of-way time was reduced by 42 per cent the total number of vehicles able to execute the turn (free from pedestrians) remained the same.

As in the scramble system the average headways also showed a marked drop. The peak minimum headway before the exclusive phase was 6.2 seconds and after the introduction 2.27, a 63 per cent reduction. Headways after the introduction were generally between 2 and 3 seconds whereas before they were 6 to 7 seconds. Even though the headways after introduction of the exclusive turn are close to those expected

for straight through traffic these cannot be classed as typical since the left turn was executed on a relatively steep grade of 1 in 12. A minimum headway of 2.27 gives 1,300 veh/10′/hour of green. The 1 in 12 grade gives a 40 per cent increase over location A.

It therefore appears reasonable to conclude from these two studies that the capacity of an intersection can be considerably increased if conflicts between pedestrians and vehicles are removed and that this increase could be as high as 60 or 70 per cent under favourable conditions. Table 2 gives the headways throughout the off peak period and peak periods before and after for both Flinders Elizabeth and Flinders Swanston Streets for the left turn vehicles.

(c) *Turning Movements*

As indicated previously both left and right turns in these studies are executed from the same side of the approach.

The left turn is only limited during the "go" period by the pedestrian interference and can be completed whenever the way is clear but the right turn has to wait for the green cross traffic signal in that direction before the turn can be completed.

Table 3 shows the minimum average headways (over half hour periods) on the 11 approaches of 3 intersections. The 12th approach has been ex-

TABLE II

VOLUMES AND VEHICLE HEADWAYS LEFT TURNING VEHICLES WITH AND WITHOUT PEDESTRIAN INTERFERENCE.

LOCATION A — SCRAMBLE SYSTEM. — FLINDERS - ELIZABETH STREETS.

B — EXCLUSIVE TURNING PHASE. — FLINDERS - SWANSTON STREETS.

TIME PERIOD	LOCATION A				LOCATION B			
	VOLUMES		AVERAGE HEADWAYS (SECS.)		VOLUMES		AVERAGE HEADWAYS (SECS.)	
	WITH INTERFERENCE	WITHOUT	WITH	WITHOUT	WITH	WITHOUT	WITH	WITHOUT
8.00 - 8.30	36	49	17.5	8.35	24	97	39.5	3.48
8.30 - 9.00	71	47	8.9	8.7	-	89	-	3.8
9.00 - 9.30	77	84	8.2	4.87	55	108	17.2	3.12
9.30 - 10.00	90	86	7.0	4.76	137	110	6.9	3.06
10.00 - 10.30	83	89	7.6	5.4	119	120	6.56	2.82
10.30 - 11.00	97	107	6.5	4.23	108	146	7.21	2.31
11.00 - 11.30	98	101	6.45	4.06	120	138	6.5	2.45
11.30 - 12.00	-	103	-	3.97	126	148	6.2	2.27
12.00 - 12.30	No	Count		No	Count	-		
12.30 - 1.00	111	-	5.65		-	-		
1.00 - 1.30	99	98	6.35	4.18	121	123	6.45	2.70
1.30 - 2.00	107	94	5.9	4.36	104	133	7.5	2.54
2.00 - 2.30	110	107	5.72	3.84	100	140	7.80	2.42
2.30 - 3.00	97	114	6.5	3.58	87	137	8.95	2.47
3.00 - 3.30	69	122	8.21	3.26	144	146	5.42	2.32
3.30 - 4.00	105	102	6.0	3.95	124	140	6.30	2.41
4.00 - 4.30	71	92	8.89	4.46	-	112	-	2.67
4.30 - 5.00	96	100	6.58	4.10	NO TURNS PERMITTED.	98	-	3.10
5.00 - 5.30	71	69	8.9	5.95		92	-	3.5
5.30 - 6.00	84	87	7.52	4.73		109	-	3.1

GREEN TIME PER HALF HOUR	630 Secs.	410 Secs.	8 - 10 a.m.	945	337 Secs.
			10am - 4 pm.	780	
			4 - 6 p.m.	900	

TABLE III

INTERSECTIONS WITH WALK-DON'T WALK PEDESTRIAN SIGNALS

LOCATION	EASTBOUND								
	MINIMUM HEADWAYS (SEC)			REDUCTION CAPACITY		PERCENTAGE $\frac{\text{TURNS}}{\text{TOTAL}}$		REDUCTION CAPACITY/TURNS %	
	NO TURNS	WITH TURNS		WITH TURNS					
		MIN. PEDS.	MAX. PEDS.	MIN. PEDS.	MAX. PEDS.	MIN. PEDS.	MAX. PEDS.	MIN. PEDS.	MAX. PEDS.
FLINDERS-SWANSTON	3.0	4.1	7.0	25%	56%	22	30	1%	1.9% to 1%
COLLINS "	2.7	3.3	4.3	18⅔%	41%	17	15	1%	2½ - 1
BOURKE "	2.5	3.7	7.3	24%	65%	12	8	2%	8% - 1
	WESTBOUND								
FLINDERS-SWANSTON	2.9	3.7	4.7	25	40	40	40	2/3	1
COLLINS "	2.5	2.9	3.7	13½	35	12	12	1	3
BOURKE "	3.0	4.8	5.7	37	46	25	23	1½	2
	NORTHBOUND								
FLINDERS-SWANSTON		NOT DONE DUE TO ODD INTERSECTION							
COLLINS "	2.8	4.8	6.0	42	53	19	15	2.0	3.5
BOURKE "	2.8	5.2	5.7	46	50	19	21	2.5	2.5
	SOUTHBOUND								
FLINDERS-SWANSTON	2.2	3.1	4.3	31	47	13	12	2.5	3.9%
COLLINS "	3.5	4.5	6.3	20	43	23	14	1.0	3.0%
BOURKE "	3.5	3.8	5.9	5	39	8%	13	1.0	3.0%

ALL INTERSECTIONS HAVE WALK-DON'T WALK PEDESTRIAN SIGNALS
MAXIMUM PEDESTRIANS ARE FROM 1.30 - 2.0 P.M.
MINIMUM PEDESTRIANS ARE BETWEEN 10 - 11.30 A.M.
2.30 - 4.0 P.M.

RANGE	1 - 2⅔%	1-3.9%
AVERAGE	1.4	2.7
MOST COMMON OCCUR	1	2.5

U.S.A. REDUCTION 1% FOR 1%.

TABLE IV

REACTION-TIME SIGNALS

TYPE 1. SIGNAL SEQUENCE. R - G - A - R - G - A . . .

TYPE 2. SIGNAL SEQUENCE. R - RA - G - A - R - RA - G - A . . .

TIMES TAKEN FOR VEHICLES TO MOVE OFF.

	1st CAR	2nd CAR	3rd CAR	4th CAR	5th CAR	6th CAR
TYPE 1.	2.2 SECS.	2.9	3.8	5.2		
TYPE 2.	0.7 SECS.	1.6	2.0	3.3	3.9	5.2

cluded because of its nonstandard arrangement.

All the approaches are at intersections where separate pedestrian signal indications are in force—that is, there is a 10 second clearing period for pedestrians. The table gives, as well as minimum headways with and without turning movements, the proportion of left and right turns to total turns during the minimum headway condition.

Since the right turn is forced to store (by law) then its effect on the intersection capacity is only governed by the storage space within the intersection—pedestrians would not affect the situation since vehicles are not permitted to turn through them. With left turning vehicles the situation is different since they have to turn through pedestrians and any abundance of these will prevent the movement, cause vehicles to bank back from the approach and block one lane until they clear. This may well have a cumulative effect on the right turns by also preventing them from entering the intersection. Similarly the right turns may, due to insufficient storage, bank back and prevent left turns. In either case the inside or curb lane suffers because of the turns and this is apparent from lane usage counts that have been conducted. The volume using the curb lane is approximately 35 per cent of total traffic. Study indicates therefore that the principal reason for high headways is the pedestrian interference again.

A few general trends are apparent from this table.

(i) There is a marked difference between the "no turns" condition and the situation when turns are present at minimum and maximum pedestrian times.

(ii) Actual reduction in capacity can be considerable, in one case 65 per cent.

(iii) In terms of per cent reduction per per cent of turns, the most commonly occuring reduction is 1 per cent per 1 per cent turns at time of minimum pedestrians; 2½ per cent per 1 per cent at time of maximum pedestrians.

(iv) Difference of grade is apparent. Collins-Swanston Streets westbound is on a 1 in 20 downgrade and this gives significantly lower figures than for the other approach legs.

(v) In all cases the proportion of left turns is greater than or equal to the proportions of right turns.

From a study of Tables 2 and 3 it appears as if the minimum headway to be expected with turning vehicles is 3 seconds under ideal conditions.

Repeated headways of 3 to 3.5 seconds have been recorded at periods of low pedestrian flow in conjunction with pedestrian signals. The fact that headways increase markedly during periods of heavy pedestrian flow (despite the pedestrian clearing period) would indicate that there is a critical pedestrian flow above which there are significant headway increases.

(d) *Signal Sequence*

Table 4 lists the results of extensive studies on the reaction time of vehicles at a signalized intersection. The normal light sequence in Victoria has been for many years Red, Green, Amber, Red, Green etc. and it was thought that greater efficiency of operation could be obtained by introducing the preceding amber. The light sequence being then Red, Red-Amber (simultaneously) Green, Amber, Red, Red-Amber etc. As can be seen in the table the reaction time of the first car has been reduced from 2.2 to .7 seconds. This spectacular decrease in reaction time has caused the city to introduce preceding amber into every one of its 67 signalized intersections.

The resultant increase in capacity has been between 4 and 5 per cent.

Intersection Control and Capacity

The Highway Capacity Manual indicates that the type of signal system makes little difference to the possible capacity of the facility.

"The benefits accruing to vehicle operators as a result of a progressive signal system are reflected in a saving in time to the traffic using the facility, but this saving declines rapidly when practical capacity is exceeded.

"The saving in travel time with a progressive system is not directly related to the ability of the street to handle traffic in terms of number of vehicles.

"Normally the actual number of vehicles that can pass a point during one hour is not increased appreciably by a progressive system."

Table V indicates the principal findings of a six weeks trial on 12 intersections of a single street.

The principal conclusions from the survey were:—

(i) All forms of signal control are superior to police control. The average of the *three* forms of signal control in terms of vehicles moved per hour of green shows that in the morning peak signals moved 23½ per cent more traffic than police and in the evening 15 per cent more.

(ii) Co-ordinated signals are more efficient than isolated signals, moving 12.4 per cent more vehicles per hour of green 130 per cent faster in the morning and 1.0 per cent more vehicles 80 per cent faster in the evening.

(iii) Signals set for 23 m.p.h. move 17.4 per cent more vehicles 14 per cent slower than the next best form of control in the morning and 10 per cent faster than the next best form of control (isloated signals) in the evening peak.

(iv) Signals set for 15 m.p.h. are the most efficient during off peak periods giving an increase in average speed of 35 per cent north bound and 20 per cent south bound over the other forms of control.

(Continued on page 24)

The Highway Engineer And the National Committee On Urban Transportation

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(Jun. Mem., ITE)
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THE National Committee on Urban Transportation is concerned with the efficient transportation of people and goods — which has always been considered the life blood of the urban community.

Good transportation expands economic, social and cultural opportunities, and tends to improve the whole urban environment. A major consideration with industry in locating new plants is convenient and economical transportation. For example, in selecting a site for a new plant, a particular industry will survey many communities to appraise comparative advantages of each, including transportation facilities and services. Obviously, then, cities that face up to the urban transportation problem through the development of a sound over-all planning program will be in a better competitive position to attract new industrial and commercial enterprises.

For many years it has been apparent to local officials that continuing population growth in our metropolitan areas will greatly magnify the problems of providing adequate transportation facilities in the future. The urban area of today is a complex of individual municipalities, each jealously guarding its right of self government. On the other hand, since transportation refuses to recognize municipal, county, or state jurisdictional lines, an effective solution to metropolitan transportation problems requires a cooperative approach. The program of the National Committee is the first step, by public officials, to cope with these growing problems.

It is important for highway engineers to evaluate this program and attempt to understand how its application is related to the construction of the highways authorized under the 1956 Highway Act—the biggest construction job in the history of the world.

Recognizing the urgency of solving these problems, six national organizations of public officials formed the National Committee on Urban Transportation in May 1954. These were the International City Managers Association, American Municipal Association, American Public Works Association, Municipal Finance Officers Association, American Society of Planning Officials and the National Institute of Municipal Law Officers. Thus, representatives of these organizations laid the groundwork for a concerted attack on basic urban transportation issues. The Bureau of Public Roads accepted membership shortly after the Committee was organized. In May 1956, the National Association of County Officials, and the Canadian Federation of Mayors and Municipalities became members.

The Committee set as its first objective the development of a manual of methods and procedures by which cities could undertake a complete fact-gathering program to help evaluate deficiencies, project future needs, and formulate a more realistic transportation policy. Fact-gathering for the State Highway Department Planning Surveys, if carried out on a continuing basis, produces a fund of valuable information so that states can determine existing and future deficiencies. Most cities lack such a stock-pile of factual data. This lack of data became evident in 1954 when the Clay Committee, in attempting to determine the over-all highway needs, found very little information concerning street and highway needs in the urban areas.

To carry out this work, the National Committee created nine subcommittees staffed with over 160 outstanding specialists selected from city, county, state, and the Federal government, and from universities and consulting fields. The specific study areas covered include: Transportation Administration; Laws and Ordinances; Financial Records and Reports; Level of Existing Transit Service (including such studies as route coverage, passenger load data, travel time, transit speed and delays, and passenger riding habits); Inventory of the Physical Street System; Level of Existing Traffic Service (including such studies as accident records, parking, travel time, volume counting, capacity and an inventory of traffic control devices); Recommended Standards for Street Facilities and Services; and Recommended Standards, Warrants, and Objectives for Transit Facilities and Services.

After a preliminary manual was completed in early 1956, seven pilot cities were selected to test the procedures developed by the nine subcommittees. The pilot cities were San Diego; Phoenix; Albuquerque; Detroit, Pocatello (Idaho); Oak Park (Illinois); and Syracuse.

As a result of pilot study experience, field study techniques were improved and committee goals were amplified to

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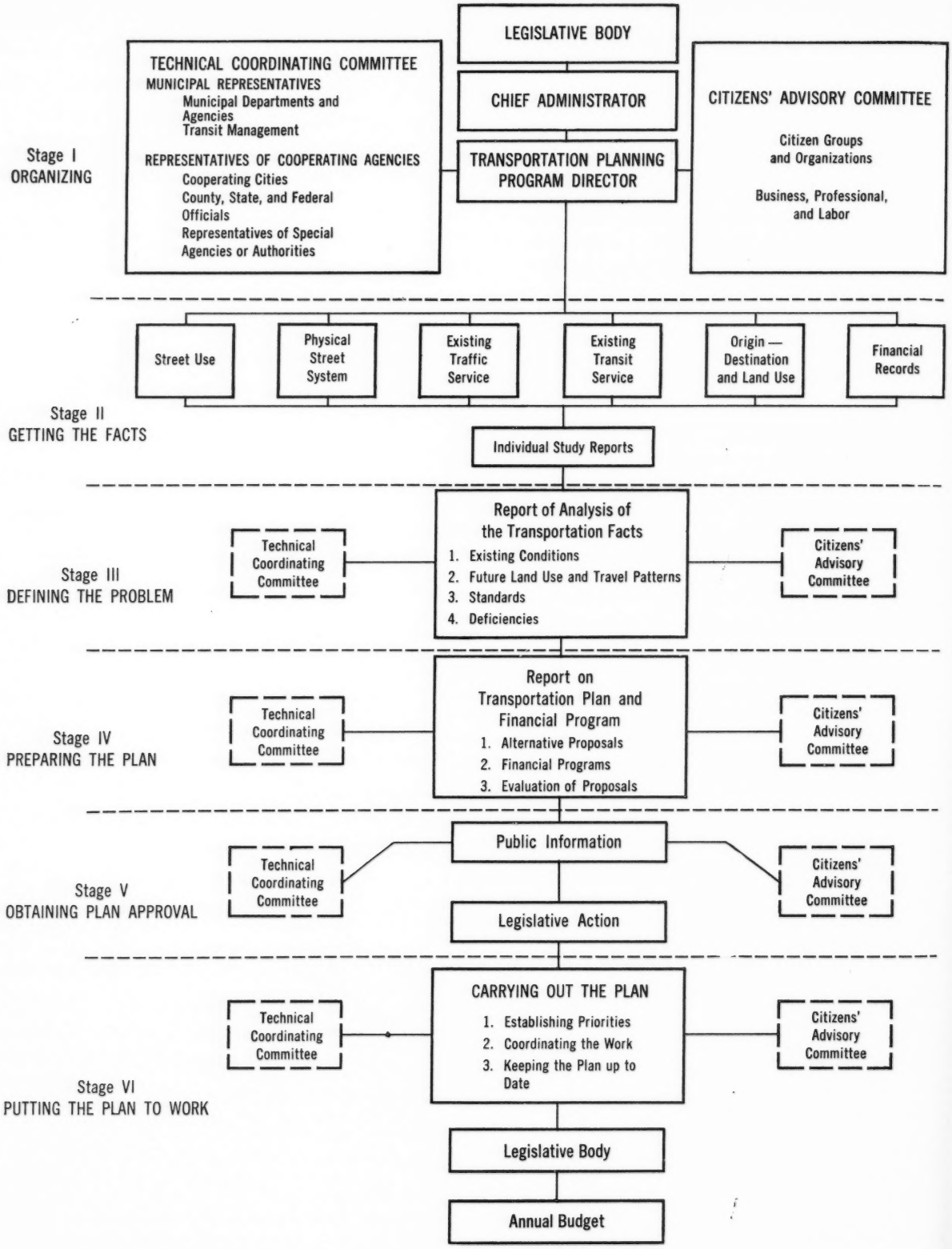
ESTABLISHING A TRANSPORTATION PLANNING PROGRAM



provide additional guidance not only in organizing and carrying on an effective fact-finding program, but also in applying the information toward the development of a sound transportation plan. The completed work of the Committee consists of a basic "Guide" entitled "Better Transportation for Your City," and a supplementary series of 15 detailed procedure manuals. Both the Guide and the procedure manuals are now available from the Public Administration Service in Chicago, publisher for the National Committee.

The Guide is a brief document designed for use by mayors, city managers, councilmen, state highway engineers, transit officials, department heads, and interested citizens. It presents in simple direct style how the over-all program should be organized, the studies to be carried out, and the sequence in which the work program is to be accomplished. The procedure manuals were prepared for use by technicians and field personnel in carrying out each of the detailed studies recommended.

Both the Guide and the 15 procedure manuals present an important innovation in the development of over-all transportation planning. For the first time, technicians in the field have available a complete set of carefully organized and tested procedures to guide them in developing their *own* transportation planning program.

The organizational framework of the program recommended by the National Committee is shown in Figure 1. Stage I, Organizing, is the most important step in the entire program, for it is in this stage that legislative approval is obtained, the respective role of all cooperating agencies and departments is fixed, and specific work responsibilities are assigned. Therefore, organization of the program in its initial stage will in all probability determine whether it will be a truly successful effort. You will note that a Technical Coordinating Committee is to be formed and that the entire program is to be administered by a transportation planning program director. This type of organization provides the working mechanism for interdepartmental or intergovernmental cooperation, without which a broad program of this type cannot produce good over-all results.

Organized at the same level as the Technical Coordinating Committee is a Citizens Advisory Committee. This Citizens Committee is necessary to insure that the plans to be developed will receive necessary public understanding and support. You also will note that the transportation planning program is to be established by official action of the legislative body. All six stages of the program as charted are technically under legislative direction. It should also be observed that in Stage VI, "Putting the Plan to Work," the recommended program comes up before the legislative body for final approval.

To be effective, the planning program must be continuous because transportation is in itself dynamic and subject to many changes. In stressing the continuous aspect of this program, it is appropriate to quote a statement made by Mr. C. D. Curtiss, former Commissioner of the Bureau of Public Roads: "In too many present instances we face the possible necessity of having to plan and design the urban expressways without facts based upon continued study. Perhaps our most important problem in the planning field is the coordination of highway planning with city and regional planning, in and around urban areas. Highway construction under the interstate program alone in the years ahead will have a profound effect on the growth and development of urban areas for many years to come."

The pilot city programs of the National Committee have been a wonderful proving ground for testing both new and old study techniques. Pilot city experience provided the refined data from which the procedure manuals were developed. It should be made clear that these manuals are generalized in some respects to permit modifications so that they can be utilized by cities of all sizes. Naturally, presenting technical information in such a manner involves many difficulties, but this objective was accomplished by presenting alternative study techniques.

As mentioned earlier, San Diego is one of the pilot cities. San Diego has made noteworthy progress because of excellent leadership and management, particularly in carrying out Stage I—"Organizing." Cooperating with San Diego in this undertaking were the California Division of Highways, San Diego County, San Diego Transit System, six cities in the metropolitan area, and the 11th Naval District.

Here are some of the benefits from the program reported by San Diego:

1. Close cooperation and understanding has developed between city departments, and between the City of San Diego and the California Division of Highways. The program has also promoted closer teamwork among the six cities, the County, the State, and the Transit System, along with the 11th Naval District.

2. It has brought about a closer working relationship between the Transit System and the City.

3. New or more usable information on street transportation expenditures has been provided for administrative purposes.

4. Certain relationships between land-use and travel characteristics have been determined. These have served to expedite studies of metropolitan population and land-use for the development of a land-use plan.

5. Useful factual data have been assembled on existing street surfaces, accidents, volumes, street capacity, travel time, convenience of movement and parking.

In addition, the City has been provided with an inventory of the physical street system, including structures, lighting, and traffic control devices. The program has produced a deficiency study and a 1971 highway needs study and has developed the relationships and methodology for intensive factual review of freeway, major streets, and highway plans.

The San Diego benefits enumerated above indicate that the program recommended by the National Committee provides the over-all approach required by cities that are desirous of attacking the transportation problem on a factual basis.

Another pilot study that has shown excellent results is in Phoenix, Arizona. The Technical Coordinating Committee charting this program was composed of representatives of the City of Phoenix, Maricopa County and the State Highway Department. The Phoenix Traffic Study, a report just published, was prepared with the assistance of high speed computers and new techniques for cataloging data and projecting future traffic. Phoenix provided an excellent opportunity for a repeat origin and destination survey at the recommended ten-year interval. The rapid expansion of its suburban areas, together with the development of out-

lying shopping centers, has altered the travel desires of the people of Phoenix to a marked degree since the previous study completed in 1947. This again exemplifies the dynamics of transportation and the need for continuous studies to chart these changes so that they may become a part of the transportation plan.

In this connection, *Street Engineering* Magazine, in its issue of June 1957 regarding test procedures for gathering basic traffic engineering data in Oak Park, Illinois, another Pilot City, said: "It seems strange indeed that a long established community fully aware of all the problems and complexities brought upon it by today's vehicular traffic needs some outside impetus to move it toward some comprehensive plan of attack. This, in effect, is what happened to the village of Oak Park, Illinois. By following the new manual, Oak Park village officials have — in a period of less than one year, at relatively little expense—armed themselves with background information which will strip the guesswork in the future planning of the modern street transportation system of the community."

The Bureau of Public Roads has participated actively in the development of the program of the National Committee. In fact, during the pilot city program, the Bureau assigned advisors in the following areas: The Measurement of Existing Traffic Services; Administration; Modernizing Laws and Ordinances; Standards for Street Facilities and Services; Financial Records and Reports; Parking; and Origin and Destination Studies. The views of these advisors and their experience in the pilot study program are reflected in the procedure manuals.

To repeat, these manuals were not designed for cities of any specific size or character. The manual techniques are not rigid, but are adaptable to the changing requirements of cities and metropolitan areas. No attempt is made to define the ultimate shape of the community. What this ultimate shape or plan might be is the responsibility of the community itself. An article by Victor Gruen, in *Architectural Forum* gives his concept of a plan for Fort Worth, Texas. Ebenezer Howard's "Garden City" idea, developed in England in the early 1900's, also presents a concept about the desirable shape of the urban community. It is interesting to note that transportation was basic to both of these concepts.

The major significance of the National Committee's program is the fact that this is the first time public officials have banded together to attack the urban transportation problem. By developing this program, the National Committee has made it possible for cities and urban areas to overcome a serious informational void with respect to transportation needs. If carried out on a nationwide basis, the program would provide a wealth of information that would be of great value at all levels of government. The urban area is, in itself, a research laboratory and only by use of this laboratory on a national scale can new ideas and techniques be developed, tested and refined for the benefit of all concerned.

Because the urban transportation problem is so complex and so vast in scope, a broad over-all effort of this kind must be properly organized, staffed and administered. In other words, sound organization and effective administration are essential to the successful development of the program. This is emphasized in the administrative procedure manual as well as the Guide Manual.

Good public relations is another requisite for the success of this program, as it is for the success of most programs. For this reason, it is recommended that a public support group (Citizen's Advisory Committee) be created at the organizational stage of the program, and that this group participate actively throughout all six stages. In this way, citizen interest can be developed through the various planning phases, and when the ultimate transportation improvement plan finally takes shape, the chances are good that it will have the support of informed public opinion.

To sum up, it would be hard to do better than to quote from the preface of the National Committee Guide Manual. It says: "This handbook was prepared to help cities do a better job of transportation planning, through systematic collection and analysis of basic facts.

"The program outlined herein, created by many of the nation's foremost authorities, is adaptable to any community or metropolitan area. Techniques described are designed to guide the development of highway, transit, and terminal improvements in a manner which will (1) afford the public the best possible transportation services, at the least possible cost; and (2) aid in accomplishing desirable goals of urban renewal, and sound suburban growth.

"This program has been endorsed by the Joint Committee on Highways of the American Municipal Association and the American Association of State Highway Officials, the American Transit Association, and numerous other national bodies.

"It has also been endorsed by the Bureau of Puublic Roads, U. S. Department of Commerce, which has actively participated in its preparation. In general, the studies embraced in the program, if included in the Statewide highway planning survey of any State wishing to cooperate in such studies, are eligible for financing assistance from Federal - aid highway funds apportioned to the state, upon recommendation of the respective State Highway Department and approval by the Bureau of Public Roads."

As a member of the National Committee, Mr. E. H. Holmes, Assistant Commissioner for Research of the U.S. Bureau of Public Roads, has actively represented the Bureau. In a recent article in *Street Engineering*, Mr. Holmes is quoted as follows: "With this handbook, city engineers can more easily than ever before determine just how great the traffic problem is, and where to look for some solutions."

It is important that everyone working with urban highways become acquainted with the broad program of the National Committee because it is the most complete and up to date source material assembled in this field. It should be kept in mind that the metropolitan area of tomorrow will be only as functional and livable as the development of its street and highway transportation system will permit.

The day is past when the highway engineer can confine his thoughts and interests to the highway per se. He now realizes that the end objective is not to build roads but to serve people. This means that the engineer must be conversant with the concepts of the great many disciplines and skills that go to make up the vast and complex activity we call urban transportation. The National Committee's program provides the vehicle by which officials at all levels of government can combine their efforts to develop practical over-all transportation plans and improvement programs.

The Measurement of Exposure to Motor-Vehicle Accidents

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Introduction

Some 16 years ago Sidney J. Williams, then director of the Council's Public Safety Division, wrote an article for the October, 1942, issue of PUBLIC SAFETY *magazine, pointing out that vehicle mileage does not adequately measure the exposure to motor-vehicle accidents in situations involving more than one vehicle. Some further consideration was given to his proposal for an improved measure, but the pressure of added work during the war made it necessary to defer any detailed investigation. Recently, interest in this matter has increased, due in part to observed differences in trends of deaths for different types of accidents. From 1941 to 1957 pedestrian deaths dropped 42 per cent, while deaths in collisions of motor vehicles increased 8 per cent, and deaths in non-collision accidents jumped 44 per cent. On the face of it, the elements of exposure for these three classes of accidents are considerably different, yet the death rate calculated from vehicle miles reflects no distinction.*

This article is, first of all, a restatement of the points Mr. Williams made in 1942. The proposal is given in greater detail, but not in essentially different form. The reader will quickly note that the rate-index suggested is still based on a simplified view of the complex traffic situation. The question is not whether the proposed change provides a "perfect" measure, but whether it is a substantial improvement over the present mileage rate.

IN THE CALCULATION of motor-vehicle death rates, three rough measures of exposure to the hazard have commonly been used: population, motor vehicles, and motor-vehicle mileage. The resulting rates have usually been stated as deaths per 100,000 population, per 10,000 motor vehicles, and per 100,000,000 vehicle miles.

Most people interested in accident prevention have for years been in agreement regarding the failure of these rates to reflect the underlying relationships between variations in deaths from year to year and variations in the amount of exposure to the hazard. The rate based on population takes into account the number of people exposed, but not the number of motor vehicles or the number of miles they are driven. The rates based on vehicles or vehicle miles take into account the volume of travel, but do not reflect the number of people exposed. It has been felt that some combination of exposure factors should be used as the basis for rates, but no method of combining the various exposure factors—people and vehicles or vehicle miles—has been in general use.

It is the purpose of this paper to discuss in some detail the nature of the exposure to the four principal classes of motor-vehicle accidents, and to put forward for consideration a method of measuring accident experience which gives a more adequate statement of what has happened than the rates mentioned above.

The four principal classes of accidents, which will be considered separately, are these:

1. Collision with pedestrian.
2. Collision between motor vehicles.
3. Noncollision accident, and fixed object collision. These types are combined because of the frequently-encountered difficulty in mass statistics in distinguishing correctly between a collision with a fixed object on or immediately adjacent to the roadway or shoulder, and a collision with a fixed object after the vehicle has run off the road.
4. All other types.

Collisions between motor vehicles and railroad trains might be considered as a separate class because different exposure factors are present. However, these accidents have accounted for less than five per cent of the deaths in recent years, and even smaller proportions of the injuries and property damage cases. The results of the procedure discussed below would be changed only slightly if collisions with railroad trains were considered separately.

Exposure factors affecting the first three classes of accidents differ a great deal, and should be considered separately.

Exposure to Collision with Pedestrians

Exposure to pedestrian accidents is a combination of the number of people and the number of vehicles or vehicle-miles. Unfortunately, there is no way of combining people and vehicles or miles into a single exposure unit, so for a rate for a single year it is necessary to use either population or vehicles (or miles). For rates for several years, however, there is a straightforward method of combining the two factors so that the trend of total exposure will be indicated, and the rates will reflect the influence of this combined trend. It is proposed that the population for the different years shall be converted to index numbers, with the base year stated as 1.00; and that the vehicle miles in each year shall be multiplied by the population index. In this way, rates which otherwise would be only mileage rates are modified to the extent that population changes, and the trend of the rates — which is the important thing — will reflect the changes in deaths or accidents resulting from changes in both vehicle miles and population.

Exposure to Collisions Between Motor Vehicles

Exposure to collisions between motor vehicles is more difficult to measure. It may be considered as a function of the number of vehicles or vehicle-

TABLE I

Car 1 might collide with, or be hit by-	Car 2 might collide with, or be hit by-	Car 3 might collide with, or be hit by-	Car 4 might collide with, or be hit by-	Car 5 might collide with, or be hit by-	Car 6 might collide with, or be hit by-	Car 7 might collide with, or be hit by-
Car 2						
3	3					
4	4	4				
5	5	5	5			
6	6	6	6	6		
7	7	7	7	7	7	
8	8	8	8	8	8	8
TOTAL POSSIBILITIES 7	6	5	4	3	2	1

miles, but the trend of exposure from year to year is considerably different from the trend of vehicles or miles. Consider this situation: Four cars are approaching an intersection, one from each direction. There is the possibility that car 1 will collide with car 2, car 3 or car 4; or that car 2 will collide with car 3 or car 4; or that car 3 will collide with car 4—a total of 6 possibilities of collision among the 4 cars. Now double the number of cars, two from each direction, and count the number of possibilities of collision, including rear-end (Table I).

Adding, the possibilities of collisions between vehicles in this situation total 28. Thus, when the number of vehicles is doubled, from 4 to 8, the number of collision possibilities—that is, the exposure to such accidents — increases from 6 to 28, or more than 4 times.

Substantially the same situation exists in the roadway between intersections. If cars 1 and 2 are traveling in one direction and cars 3 and 4 are traveling in the opposite direction, car 1 might collide with car 3 or car 4, and car 2 might do the same. In addition, there is the possibility of a rear-end collision between cars 1 and 2 and between cars 3 and 4. This is a total of 6 collision possibilities. Now, if the number of cars is doubled—4 traveling in each direction — there is the possibility of each of the cars traveling in one direction colliding with any of the 4 approaching cars, or a total of 16 possibilities. In addition, there is the possibility of a rear-end collision between each car and the car ahead of it, or 6 possibilities of such collisions among the 8 cars. Thus, there is a total of 22 possibilities of collision for the 8 cars, compared to 6 possibilities for the 4 cars. It is also conceivable that the fourth car of the group traveling in each direction might have a rear-end collision with the second or first car in the group if it tried to pass the string but was forced back into line by approaching vehicles. However, this is a circumstance not uniformly present, and therefore should be considered separately.

Summarizing, at intersections when the number of vehicles was increased from 4 to 8 the number of collision possibilities rose from 6 to 28, or more than 4 times as much; between intersections, increasing the vehicles from 4 to 8 increased collision possibilities from 6 to 22 — almost a 4-times increase. It will be noted that these increases are about the same as the increase in the square of the number of vehicles — thus, the square of 4 is 16, of 8 is 64, and 64 is 4 times 16. A short way of stating the change in collision possibilities noted above is this: For accidents involving collisions of motor vehicles, collision possibilities—or exposure — vary approximately as the square of the number of vehicles.

Finally, it can be stated that exposure can be measured in terms of vehicle miles as readily as in terms of vehicles, for the trends of vehicles and of miles has been almost the same in recent years. This is shown by the fact that during the last 6 years the average number of miles per vehicle has varied only between 9,608 and 9,674 — less than 1 per cent. Even if the series is carried back to 1946, the maximum difference between any two years in miles per vehicle is less than 5 per cent, which is not important in choosing between miles and vehicles as the better base for measuring exposure.

This discussion of exposure in terms of possibilities of collision implies that all traffic is on two-lane roads or streets. For rural travel, this is substantially true; in 1956 close to 90 per cent of rural vehicle miles was on two-lane highways. In cities, two lanes open for traffic is the typical situation, the remainder of the street width being occupied by parked cars. However, each year brings an increase in the mileage of four-lane undivided roads, divided roads, and limited access roads. In another decade, travel on such roads will be an appreciably larger portion of the total than at present. For four-lane roads, particularly divided roads, the possibility of collisions between vehicles is limited chiefly to rear-end collisions, and therefore the variations in exposure from year to year will tend to approach the variations in vehicle miles rather than vehicle miles squared.

As travel on such roads becomes an important part of the total, will it be necessary to change the method of figuring the exposure to allow for the smaller number of possibilities of collision per unit amount of travel on these roads? There is a good reason for not doing so. One inducement for the spending of the large amounts of money necessary to build these highways is the reduction in the number of accidents, per unit amount of travel, which experience has shown they will accomplish. If the method of calculating the amount of exposure is changed to match the change in travel from two-lane highways to the wider roads, it might produce rates that showed little if any decrease from year to year, thus concealing the benefits obtained from the construction of the better roads.

It is recommended that the method of calculating exposure — that is, squaring the vehicle mileage—be retained, regardless of the amount of travel on the wider highways.

Exposure to Noncollision Accidents And Fixed Object Collisions

Exposure to these accidents is best represented by vehicle mileage. Differences between roads in the possibility of an accident not related to travel mileage do exist — such as road surfaces and maintenance, fixed objects adjacent to the roadway, driver inattention sometimes induced by long stretches of superhighways—but these factors cannot be converted to numerical measures of hazards.

Exposure to Other Types of Accidents

It was pointed out above that collisions of motor vehicles and railroad

trains could be treated as a separate class of accidents, for exposure is a function of both vehicle mileage and train mileage. If these accidents were more frequent, the additional calculations required would be made, but as deaths are less than 5 per cent of the motor-vehicle fatality total, injuries less than 1 per cent, and property damage accidents even fewer, it is recommended that no further complications of method be introduced. Exposure, then, will be represented by vehicle miles.

The remaining types of accidents in this group—collisions with bicycles, street cars, and animal-drawn vehicles or animals, produce even fewer deaths; and vehicle mileage, therefore, is used as the measure of exposure.

Computing Rates

Rates may readily be computed, as indicated above, for each of the four classes of deaths or accidents. Also, the rates for noncollision and fixed objects and for "other" may be added together, for both of them are based on vehicle miles. Rates for pedestrians and for collisions of motor vehicles cannot be added, for they have different bases. It is not possible, therefore, to obtain a single rate which includes all classes of deaths or accidents.

It is proposed that the rates computed for the four classes of deaths or accidents be used as the best indicators of trend from year to year in the four parts of the motor-vehicle accident problem, and that primary emphasis be given to these trends. As a substitute for an all-death or all-accident rate, compute a series of index numbers that will show the amount of change over the years in the four classes of accidents, combined. The procedure will be as follows:

1. Select a base year, for which the index number will be 100. This need not be the earliest year for which information is available, for index numbers can rise above 100 as well as fall below it. The base year can be a year with some special characteristic, such as 1946—the first year after the disruptions of highway travel due to World War II.

2. With this year as the base, compute index numbers from the annual rates for each of the four classes of deaths or accidents by dividing the rates for other years by the rate in the base year, and multiplying by 100.

3. Compute the per cent distribution among the four classes of deaths or accidents in the base year. (These percentages will serve as weights for combining the index numbers for the four classes.)

4. Multiply the index numbers for each class by the percentage obtained in step 3.

5. Add these products for the four classes in each year, and divide the sum by 100. The resulting figures are the index numbers which summarize the changes that occurred in the rates for the four classes of deaths or accidents. (For an example see Table II.)

The sum of the four products is 5,576. Dividing by 100 gives an index of 56, which means that deaths decreased 44 per cent relative to the trends of exposure.

TABLE II

Example:

	Collision with Pedestrian	Collision with other Motor Vehicle	Noncollision and collision with Fixed Object	Other
	U.S. Death Rates			
1947	2.8	7.2	2.6	0.7
1957	1.0	3.2	2.4	0.3
	Index Numbers			
1947	100	100	100	100
1957	36	44	92	43
	1947 Per Cent Distribution of Deaths			
	32%	30%	30%	8%
	1957 Indexes Multiplied by Percentages			
	1,152	1,320	2,760	344

Urban and Rural Exposure

All available vehicle mileage figures are estimates, based on gasoline consumption. The national estimates, made by the U.S. Bureau of Public Roads, are believed to have a high degree of reliability, and certainly are consistent in the year-to-year trend.

These national totals are divided into estimates for urban streets and rural roads. It is possible, therefore, to calculate national rates, urban and rural, and it is recommended that this be done, for death trends have been considerably different in the two areas.

State estimates of vehicle miles are made by the National Safety Council from Bureau of Public Roads figures on highway use of gasoline, using the national average of vehicle miles per gallon. The chance of error in a particular state estimate is appreciable because the national miles-per-gallon figure is used. However, the *trend* from year to year of vehicle miles in that state contains no more error than exists in the data on gasoline consumption. As it is the trends of the death and accident rates rather than their size that are of primary importance, the mileage estimates are considered satisfactory for the purpose.

Injuries and Property Damage Accidents

Having established a method for determining the exposure to motor-vehicle accidents, and indicated how it would apply to the national death record, it would be of great interest to calculate and analyze the trends of rates for injuries and property damage accidents. Unfortunately, available records do not cover all cases, and the degree of completeness varies from year to year. Important reasons for variations in the completeness of record files are:

For Injuries

1. Slight injuries (small abrasions, for example) may not seem like "injuries" to many traffic officers, who all too frequently must observe and report multiple fractures, extensive lacerations or copious bleeding. Conscientious officers, who might be called "record-minded," probably will report the minor injuries almost as completely as the major ones, but it is doubtful if this is common practice.

2. If a driver is injured in a fixed object or noncollision accident, he may consider it his own business and not report it. In contrast, if his car collides with another car he may claim an injury even though uninjured in order to get a "nuisance claim" settlement from

the other driver's insurance company. It will be noted that these factors would affect in opposite directions the rates for the two classes of accidents, spreading them farther apart as the degree of incompleteness or dishonesty increases.

For Property Damage Accidents

1. State laws require reporting of property damage accidents only if the apparent amount of damage exceeds a stated minimum amount. As this amount varies from state to state, it is not possible to make comparisons between all states. Also, legislatures occasionally change the minimum, which results in discontinuity in the series of annual totals. As the trend of accident rates is more important than the size of the rates, this difficulty is of great significance.

2. Same as 2. above, but the driver's dishonesty may take the form of exaggerating the damage incurred or including unrepaired damage from an earlier accident. If a driver carries physical damage insurance on his car, he probably will report all fixed object or noncollision accident property damage cases in which the damage exceeds the minimum specified in the policy. Thus, the incompleteness of reporting such cases probably varies from year to year partly due to variations in the proportion of vehicles covered by this type of insurance.

These are illustrations of the reasons for incomplete reporting of injuries and property damage accidents. Persons experienced in accident investigation work probably can give many other reasons which vary in importance from year to year.

It is not possible, then, to make estimates of injuries and property damage accidents which will reflect year-to-year trends. The estimates made by the National Safety Council are based on relatively constant ratios of injuries and property damage accidents to deaths, so the estimates change in about the same degree as the annual death totals change. The Council's purpose in making the estimates is only to indicate the probable size of the disabling injury and accident totals. The estimates cannot indicate the trends of these accidents from year to year, because trend information is not available for use in making the estimates.

It is a matter of considerable interest, however, to note how much the injuries and property damage accidents might increase in the next few years if their trend is the same as the trend in exposure, for most of the costs come from these accidents. By 1976, according to the U.S. Bureau of Public Roads, vehicle mileage will have increased to 1,200 billion, or 85 per cent more than the 1957 total of 650 billion; population, according to the U.S. Census Bureau, will rise about 30 per cent. According to the method of determining exposure discussed above, the increases in injuries and property damage accidents, by type of accident, would be:

Pedestrians	+140%
Collisions of motor vehicles	+240%
All other types	+ 85%

Even though the relative frequency of the three divisions of accidents today cannot be stated, it is clear that the overall change in injuries and property damage accidents which these figures indicate is considerably more than a doubling of the totals by 1976. This is a challenge that no one interested in accident prevention can afford to ignore.

INTERSECTION CAPACITY

(Continued from page 16)

General Conclusions

(i) Capacity of certain "pressurised" Melbourne intersections is considerable in excess of Highway Capacity Manual figures.

(ii) The effect of pedestrians is quite marked particularly at maximum pedestrian flow.

(iii) Presence of a co-ordinated signal system can materially increase street capacity.

TABLE V

TRAFFIC VOLUMES VARIOUS CONTROL METHODS

SWANSTON STREET

TIME	CONTROL METHOD	NORTH DAILY BOUND VEHICLES		SOUTH DAILY BOUND VEHICLES	
		MAXIMUM VOLUME (1) PER HOUR GREEN (TWO LANES)	AVERAGE SPEED IN M.P.H.	MAXIMUM VOLUME (1) PER HOUR GREEN (TWO LANES)	AVERAGE SPEED IN M.P.H.
	SIGNALS (23 M.P.H.)	3260	10.9	1930	13.7
MORNING	" (15 M.P.H.)	2760	12.7	1650	12.7
PEAK	" (ISOLATED)	2700	5.1	1980	11.4
(8.30 - 9.30)	POLICE CONTROL	2460	9.3	1390	12.4
	SIGNALS (23 M.P.H.)	2400	8.8	3120	8.7
EVENING	" (15 M.P.H.)	2260	11.3	2580	11.2
PEAK	" (ISOLATED)	2320	5.8	2780	5.8.
(4.30 - 5.30)	POLICE CONTROL	2000	9.9	2410	9.9

		AVERAGE SPEED		ACTUAL VOLUMES	8.00 A.M.-12 & 1-6 PM
		NORTH BOUND	SOUTH BOUND	NORTH BOUND	SOUTH BOUND
	SIGNALS (23 M.P.H.)	9.8 M.P.H.	11.9 M.P.H.	9167	8590
OFF PEAK	" (15 M.P.H.)	13.1 "	13.8 "	8800	8242
(9.30 - 4.30)	" (ISOLATED	9.7 "	11.5 "	8965	8838
	POLICE CONTROL	9.8 "	11.2 "	10191	8596

N.B. (1) BASED ON AVERAGE MIN. HEADWAYS PEAK ½ HOUR.
(2) THE AVERAGE SPEEDS ARE AS COMPUTED FROM AVERAGE JOURNEY TIMES. THE SPEEDS SHOWN ARE RELIABLE TO WITHIN ±1 M.P.H.

Technical Notes

INDUSTRIAL PLANT PARKING

This report by Committee 6-F of the Institute of Traffic Engineers has been accepted by the Technical Council and was approved by the Board of Direction on January 10, 1959 as a Recommended Practice of the Institute of Traffic Engineers.

IMPROPER PLANNING of parking facilities and the lack of positive traffic controls over the simultaneous movements of vehicles and pedestrians can only result in delay, confusion, conflict and accident exposure. These unhealthy conditions are particularly evident at plant approaches during periods of shift-change when competition for space is at its peak of intensity.

The solution can best be effected by a proper allocation of space and adoption of controls in proportion to the needs of the various traffic units involved; viz., pedestrians, employee vehicles, buses, taxicabs, transient vehicles and adjacent traffic streams.

The procedures and recommendations cited below are intended to guide and assist industrial management in evaluating parking and traffic problems, and applying the most practical solutions based on accepted standard practices.

Measuring the Problem

Plant facilities for the storage and movement of vehicles often *appear* well planned and controlled. However, as is typical of even the best designed facilities, peak demand for space usage at shift-change time creates unique and often crippling conditions which require that certain adjustments be made.

Deficient storage space for vehicles and traffic congestion are the major manifestations of inadequate facilities and may be identified and corrected through logical evaluation and study.

A. Evaluation

The most common evidence of need for study of this problem is the existence of one or more of the following conditions:

1. Congested curb parking on all sides of approach roadways.

2. Overflow parking of vehicles in plant yards and driveways, on adjacent private property, along highway shoulders, at "park" and "landscaped" areas, etc.

3. Vacant stalls left in existing parking lots, between shift-changes, despite evidence of overflow parking described under (1) and (2) above.

4. Insufficient loading space for buses, taxicabs, family cars and other "pick-up" vehicles resulting in angle and double parking in traffic lanes.

5. Disorderly arrangement of vehicles in existing parking lots resulting in wasted space and reduced storage capacity.

6. Lack of or misuse of directional signs and pavement markings to control vehicle placement and movements in parking lots.

7. Insufficient means of access and egress for parking lots.

8. Entrance and exit of vehicles through the main gates against mass employee movements.

9. Blocking off of emergency vehicle access to plant premises in the event of fire, explosion or other catastrophes.

10. Isolation of traffic components due to the "shifting" of freights on railroad sidings and grade crossings during critical shift-change period.

11. Continuous left-turning of vehicles from parking lots across heavy traffic streams.

12. Promiscuous loading and unloading of group riders on access streets *outside* of defined parking areas.

13. Insufficient sidewalks, crosswalks, loading zones, and other defined means of separating pedestrian traffic from vehicular traffic.

14. Mass employee crossings on main access roads by diagonal weaving through steadily moving traffic.

15. Unusual evidence of dead delays, stopping and starting, and overloading of immediate access roadways due to inadequate controls at adjacent intersections.

B. Survey

The first step in planning a smooth, safe traffic flow system for access roads and parking lots is an analysis of existing physical conditions: roadways available, parking spaces available in areas adjacent to these streets, amount of demand for roadways and parking facilities, etc.

The most detailed record of existing physical conditions can be obtained by the preparation of a map or plan which will include such information as:

1. *Parking Facilities*

(a) Boundaries and dimensions of all areas used for parking, showing the exact location of entrance and exit drives.

(b) Arrangement of parking aisles, driveways and stalls with dimensions and parking angle.

(c) Gateways to parking lots, including widths, whether used in one direction only or serving as both entrance and exit.

(d) Type of surface, night lighting facilities, location of directional signs and markings, type of enclosure, etc., for each parking area.

(e) Number of street curb spaces for parallel or angle parking.

(f) All violations of existing parking regulations in lots, at curbs and in plant yards and driveways.

(g) Total number of employee cars requiring parking space for each shift, including transient vehicles such as family cars, buses, taxicabs, etc., of short-time duration.

(h) Description and dimensions of unused areas adjacent to existing parking lots that might be available for expansion in event more space is needed.

2. *Pedestrian Facilities*

(a) Location and use of sidewalks, crosswalks, foot-bridges, tunnels and other pedestrian facilities.

(b) Location of loading and unloading points for buses, taxicabs, etc., that bring employees to or near plant gates.

(c) Routes followed by pedestrian employees from plant entrances to parking lots, bus loading zones, approach streets, etc.

(d) Total number of employees in each shift.

3. *Access Roadways*

(a) Width, alignment and number of traffic lanes of each roadway and driveway.

(b) Physical impediments such as railroad tracks, telegraph poles, fences, draw-bridges, adjacent plants and other features which may affect the flow of traffic and parking.

(c) Direction and volume of traffic flow on all access roadways to and from the plant and in and out of parking areas. Includes also direction from which buses, taxicabs and other transient vehicles approach and leave the plant vicinity.

(d) A 15-30-minute Monday and Friday traffic volume count, *just previous to the period of maximum shift-change*, on all adjacent access intersections. Include only that traffic which is not related to the plant. This count will provide a measure of the capacities of those highways which must absorb the plant traffic released.

(e) The location and timing of traffic control signals and officer controls at all points adjacent to the plant. The timing for traffic signals means the length of green interval provided each street, and the timing of officer control means the hours each day during which an officer or other deputized authority is assigned to a specific location to control traffic.

(f) Spot location of traffic accidents which have occurred as a result of plant traffic movements.

Analysis and Recommended Standards

Once all pertinent facts have been collected and recorded as on a map or plan, by field notes and by photographs, it is a simple procedure to isolate the problem areas and set up objectives.

For the purpose of quick analysis of the plant traffic problems, this section is devoted to a development of the design features and operational controls which are recognized as reasonably sufficient standards and norms. When existing plant traffic facilities show a marked deviation from these specifications, then recommendations for the adoption of corrective measures are warranted.

A. Parking Facilities

1. *Selection of Site:*

Parking area sites should be selected on the basis of land value, size requirements, the general shape and contours, and proximity to plant and access roadways.

(a) *Land values* — Generally, the problem of procuring additional land for parking development is not a costly problem with the isolated plant located on the city's "fringe." Consideration of land use for parking becomes extremely important, however, at plants located in congested industrial districts with high land valuation and usage.

(b) *Size requirements*—The overall amount of land required for parking depends upon the number of vehicles to be accommodated and the type of parking planned.

A shift of workers arriving before work to replace an equal or larger group that is leaving, imposes a load on the parking facilities which is about double that adequate for either shift. For a simple three-shift plant, the number of automobiles arriving for the next largest shift, when *added* to the number of automobiles needed for the main shift indicates the capacity of parking facilities required.

The best estimate of the actual number of cars to be accommodated is obtained through a questionnaire of employees of each shift. A quick rule of thumb measure would be one car for every two employees in each shift, based on current personnel ratios.

In general a parking area should provide approximately 60% of total square footage for storage and the remaining 40% for movement of cars.

(c) *Shape and contour of Land*—The shape of a land parcel will determine to a large degree whether more or less aisle space or maneuvering space is necessary. A regular rectangular shape with easy access from any two sides will permit an increase in storage capacity over that land which is irergular with limited access.

Land which is hilly, wooded or swampy will require considerable grubbing, clearing, and filling preliminary to final shaping and surfacing. The advantage of low land value for uncleared property may be far offset by large initial investment in making such land suitable for storage of vehicles.

(d) *Proximity to plant and access roadways*—Where practical and convenient, a parking facility should be placed in close proximity to the generator. Parking violations and property misuse by employees will be proportionate to the inconvenience caused them in traversing between the parking facility and the plant. A well-designed parking lot, incorporated as part of the plant premises, can add considerably to the functional efficiency and general appearance of the plant.

A parking facility should be located adjacent to one or more access streets of sufficient width (two 12 ft. lanes minimum) to permit turns into and out of the lot without serious conflict with moving traffic. The ideal situation is the placing of a parking facility *between* two one-way feeder roads, each having two lanes of 12 foot minimum width; one road carrying vehicles to the lot and the other carrying vehicles away from the lot. In no case should the parking facility be placed so that the feeder connections with main approach are restricted "bottlenecks" of insufficient width to receive and discharge vehicles using the parking facility.

2. *Layout of Parking Lots:*

The discussion to follow is based on "head-in" or "drive-in" parking at angles of 90, 60, and 45 degrees only. Although 45- and 60-degree angle parking is preferred from the standpoint of convenience in maneuvering, it is also true that these acute angles of parking require more space per stall and lack the flexibility of 90-degree parking, being less adaptable to irregular areas. It is, therefore, necessary to first ascertain the amount and shape of land available for storage purposes and the number of cars to be accommodated before a decision can be made as to which angle of parking is most suitable.

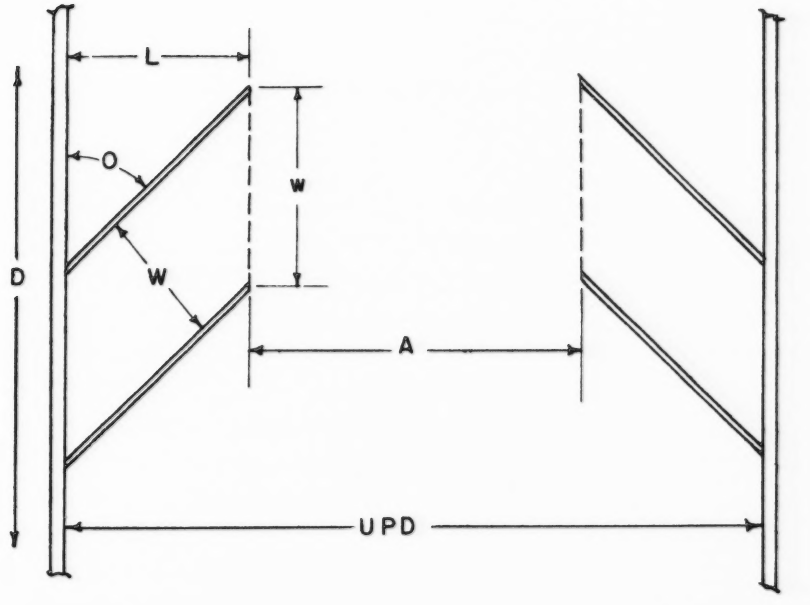
Experience has proven that in lots where employees park their own vehicles, stall dimensions less than an 8′ x 18′ minimum will result in serious space inconveniences and "crowding." which in turn cause damage to vehicles, time loss to parkers, and an overall inefficiency in lot operations. Current trends in vehicle design toward larger doors and exaggerated extremities would dictate that 8′-6″ x 18′-0 stalls are most practical. Figure 1. shows recommended stall and aisle dimensions for drive-in parking.

(a) *Parking stall arrangement*—In fitting parking stalls and access aisles to the dimensions and shapes of land parcels, it is convenient to use the width of an aisle plus the length (or depth) of a stall on each side of it as a unit of measure. Authorities refer to this measure as the Unit Parking

FIGURE 1

RECOMMENDED STALL AND AISLE DIMENSIONS
FOR DRIVE-IN PARKING

ANGLE OF PARKING	WIDTH OF STALL	DEPTH OF STALL PERPENDICULAR TO AISLE	WIDTH OF AISLE	UNIT PARKING DEPTH	WIDTH OF STALL PARALLEL TO AISLE	NUMBER OF STALLS IN GIVEN DISTANCE
O	W	L	A	UPD	w	D
90°	8'-6"	18'-0	24'-0"	60'-0"	8'-6"	$\frac{D}{8.5}$
60°	8'-6"	18'-6"	18'-0"	55'-0"	9'-10"	$\frac{D-11}{9.8}$
45°	8'-6"	17'-6"	12'-0"	47'-0"	12'-0"	$\frac{D-17.5}{12}$



Depth and it has a particular value for each angle of parking.

Parking space will be used by employees with greater overall efficiency if each stall is carefully defined by lining or marking. The material to be used for designating stalls will depend, for the most part, upon the material used for surfacing the parking area. Obviously white or yellow paint is the most economical means of lining stalls on blacktop or concrete surfaces.

(b) *Surfacing:* It is advisable that the land selected for storage of vehicles be surfaced with some dustless material, after grading. Surface types may include bituminous or concrete pavement, cinders, crushed stone, or washed gravel, with arrangements made to incorporate some simple, effective means of drainage of the area.

A permanent type surfacing is recommended since it provides:

(1) Good drainage

(2) Reduced maintenance
(3) Orderly layout of stalls with paint
(4) Attractive appearance

(c) *Fencing and Lighting* — There are certain proven advantages to be gained by enclosing a parking facility.

(1) It forces vehicles entering and leaving to use gates
(2) In unattended areas, it reduces vandalism and protects employee vehicles.
(3) It defines overall limits for parking and adds greatly to appearance.

An industrial-type woven wire fence at least 5 feet in height is most commonly preferred at plant sites.

If the lot is to be used after dusk, floodlights, providing a minimum horizontal level of 0.2 footcandles (lumens per square foot), should be arranged in each parking row at intervals of 150 feet and mounted at a height of 25 feet. As high as 2 foot candles of illumination is used at large lots.

(d) *Aisles:* No special provision need be made for defining aisle widths since the extremities of parking stalls will fix aisle location.

Use of aisle space for parking purposes should be discouraged at all times, even during hours of peak demand. A well planned lot of sufficient capacity to accommodate parking demand will eliminate the need for aisle parking.

(e) *Entrances and Exits:* The number and location of entrances and exits must be in keeping with the lot size and flow. At least 26-foot width of entrance is required where 2-way flow is to be accommodated and where vehicles are turning into or off of a main route. Single lane entrances should be at least 14 feet wide at the property lines, and single lane exits a minimum of 10 feet. Gateways should be marked by suitable signs if they are to be used solely for entrance or exit. The preferred arrangement would separate the entrances from the exits and locating both at suitable distances away from any intersection.

At least one more exit than there are entrances should be provided to accommodate peak loads thrown upon exit facilities by employees leaving in a much shorter period than they arrive.

Cars should be parked in separate sections of the lot, adjacent to their respective entrances and exits. Each shift should be provided with a separate section where possible. If they are permitted to intermingle, a serious multiplication of crossing conflict occurs when they leave their stalls and seek divergent exits.

(f) *Plan of Circulation:* Traffic circulation within lots is ordinarily best when one-way counter-clockwise movement through the main aisles of the lot is posted and enforced except where the circulation pattern is arranged to conform with one-way traffic movement on adjacent streets.

One-way movement is best obtained at parking angles of 45 and 60 degrees when vehicles are arranged in double rows all heading in the same direction.

Figure 2 illustrates common flow diagrams for one and two-way movements. These simple line drawings are intended to merely indicate basic flow. They may be used in multiple or in combination.

In any case, the plan of circulation which is adopted should permit the most flexible and smoothest flow possible as determined by the angle of parking, available aisle space and the location of entrances and exits.

Wherever control of flow can be facilitated by use of portable signs or pavement markings, such installations are recommended.

Directions and regulations should be explicit, brief and plainly visible to drivers, with symbols used when feasible.

3. *Accommodation for Transient Vehicles:*

The number of transient vehicles which require parking accommodations at or near plant grounds is dependent upon the nature of the business and manufacture conducted at each plant. These transient vehicles are generally representative of company executives, salesmen, servicing enginers, visitors, and employees' families.

The "stand-by areas" for transient vehicles can be distributed strategically at or near the plant premises in the form of separate parking rows of sufficient size to accommodate the transient unit assigned. The erection of appropriate informational signs will serve to direct drivers of transient vehicle to their assigned "stand-by area," thus eliminating confusion and misuse.

4. *Loading and Safety Zones:*

It is not always possible to segregate completely buses, passenger cars and pedestrians, but their coincidental use of the same road space or other area should be kept to an absolute minimum. Where substantial bus, taxi or transit service is required, provisions should be made for the loading and unloading of passengers (who are actually pedestrians) at points separated from other traffic movements.

Bus and transit stations in conjunction with loading platforms are a positive means of isolating these points of pedestrian attraction, and they should be strategically located to one side of access roadways and as close to the plant premises as is feasible.

Bus loading points should be designed with broad aisles and stalls, with raised platforms between the bus stalls to allow passengers ample protection while waiting to board, or when alighting.

Since the erection of loading platforms or waiting stations is often beyond the economic and cooperative means of those agencies concerned, bus loading at the curb is the most common method for accommodating employee passengers. This being the case, sufficient space must be *reserved* at the curb to permit buses and taxicabs to park parallel to the curb, free of moving traffic streams, and to allow employees to board or alight directly at the sidewalk. Complete prohibition of curb parking by other than the public carrier vehicles must, therefore, be enforced at these loading points.

B. Pedestrian Facilities

The handling of pedestrian movements is as important a problem outside of the plant proper as it is within the plant. Every care must be taken to reduce conflicting paths of pedestrians with vehicle movements to a minimum. When such conflicts *must* prevail, the need for confining and regulating pedestrian movements is imperative.

1. *Parking Areas:*

The provision of pedestrian gates, in addition to the main entrance and exit gates for vehicles will eliminate many of the common congestion problems at parking lot gates.

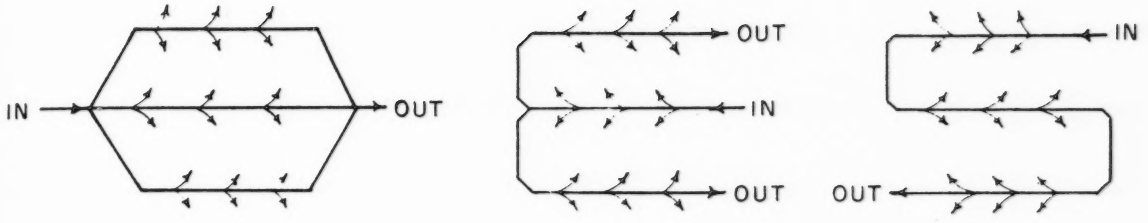
Pedestrian gates should not be less than three feet in width, and should exist in sufficient number and be so located as to permit easy access of the employees to that section of the parking lot wherein their vehicles are stored.

Raised sidewalks or separation walkways between rows of cars and border-

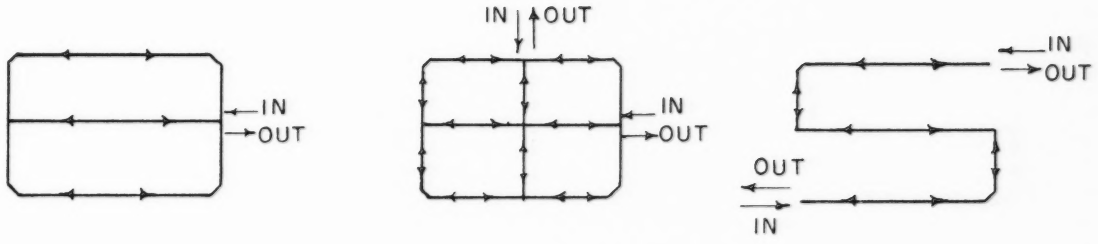
FIGURE 2

PARKING LOT CIRCULATION
ONE AND TWO-WAY MOVEMENTS
SIMPLE FLOW DIAGRAMS

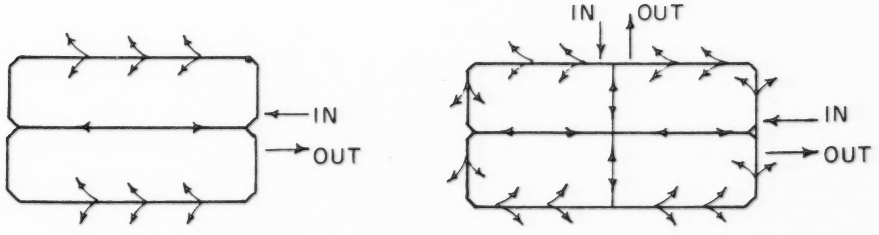
ONE WAY



TWO WAY



COMBINED ONE AND TWO-WAY



ing the fence line should be no less than six feet in width to permit free walking room, and at least 6 inches in height and faced with a curbing to prevent vehicles from parking thereon or crossing over.

Experience has proven that raised separation islands are expensive and seldom used by employees who prefer walking in aisleways; at many locations raised islands have created a serious tripping hazard and snow removal problem.

2. *Cross-walks and Sidewalks:*

All access roadways immediately adjacent to the plant and upon which groups of vehicles move in or out of the premises, should be provided with raised sidewalks to remove pedesrtians from the traffic lanes.

Cross-walks should be marked on the pavement at all intersections immediately adjacent to the plant where there is material conflict between vehicles

and pedestrian movement. Marked cross-walks should also be provided at other appropriate points where there is substantial pedestrian movement, as at long loading islands, or entrances to parking lots, or where pedestrians are permitted to cross between intersections, or where pedestrians could not otherwise recognize the proper place to cross.

Cross-walk lines should not be less than 6 nor more than 18 inches wide, and in no case be spaced less than 6 feet center to center.

3. *Footbridges, Tunnels, etc.:*

Special pedestrian facilities as footbridges and tunnels may be warranted where pedestrians are required to cross main-line railroad tracks and high-speed highways or heavily traveled highways in order to enter or leave the plant premises.

C. Access Roadways

Access roadways, as referred to in this discussion, are intended to mean those roads, streets, or highways which are adjacent to or about the plant premises and which, together with intersections, side-streets, driveways, etc., compose the plant "approach."

Access roadways may be lightly traveled rural feeder roads, heavily traveled rural highways, or urban through streets; and they may serve the interests of the plant alone, or provide travelway for the plant, city, state and all abutting property.

In any case, the importance to plant management of an access roadway lies in its fluidity and capacity to carry large numbers of employee vehicles regularly to and from the plant with safety, order and expedience.

In addition access roadways may serve to carry large quantities of material which a plant receives or ships by highway.

1. *Geometric Design and Layout:*

Access roadways should in no case be less than 20 feet in width to permit free turning movement into and out of parking areas and to reduce intersectional conflicts.

Where physically possible plant premises, including parking areas, should be sufficiently set back from major highways to reduce critical conflicts between the movement of vehicles serving the plant and public traffic. The ideal situation provides long feeder access roadways between the plant premises and the major thoroughfares, thus permitting plant traffic to "spread out" before it reaches major traffic streams. This situation is more common to plants located in rural areas than those located in dense industrial districts of large cities.

The requirements of special traffic design and control methods for access roadways will increase in proportion to the proximity of major thoroughfares to the plant premises. These special design and control features may include separate turning lanes, acceleration and deceleration lanes, cutbacks of curbs for bus loading, lane markings on pavements, traffic signal devices, SLOW and STOP signs, traffic officer controls, staggered hours for shift-change at adjacent plants, etc.

2. *Control of Approach and Departure:*

When access roads to parking areas are major highways carrying through traffic in excess of 400 vehicles per lane per hour, directional signs and pavement lane markings will be required to get employee vehicles into the proper lane well in advance of entrances to parking areas. For example, if two or three gateways are to be used as entrances to parking areas along major access highways, the vehicles which are to turn into each entrance should be directed into the right-hand lane as far back from each entrance as possible so that through moving vehicles may continue in the next lane to the left without being obstructed.

Minor access roadways to plant premises which intersect major highways may present a problem during peak periods of shift-change. The merging of heavy employee vehicle loads from the parking areas onto the major highways carrying in excess of 400 vehicles per lane per hour may create serious conflicts with moving traffic streams unless traffic signals or police protection are provided.

Traffic control signals at such intersections should be equipped with program timers, manual controls or semi-actuation to adjust the "go" or green interval to fit the needs of the unbalanced flows occurring during shift change.

The services of a traffic officer during shift-change is often warranted at unsignalized intersections of access roads and major highways, or at points of parking lot discharge directly onto major highways. The officer may coordinate his hand signals with those of any traffic signals in the immediate vicinity, thus permitting maximum efficiency of movement. If the services of a police officer are not available for necessary shift-change traffic control, a deputized plant guard should be substituted. Because of his limited authority, the plant guard can be used most effectively to aid drivers in selecting adequate gaps for entering main traffic streams.

3. *Routing of Vehicles:*

The direction of traffic flow on access roadways to and from the plant premises and into and out of parking areas should be carefully controlled to permit maximum freedom of movement and minimum conflict.

When access roadways are used primarily to serve plant vehicles, every attempt should be made to provide one-way flow of traffic between the plant premises and major highways. The strategic layout of parking areas will aid materially in providing a desired one-way circulating movement.

Large vehicles such as buses and trucks should approach and leave the plant on separate roadways. Each terminal facility can serve as a self-operating traffic circle or separation to force vehicles into one-way movement if properly designed.

Conclusion

The variations between plants as to available land area, proximity to major highways, quantity of plant traffic, etc., precludes the presentation in this report of any *absolute* specification for the design of terminal facilities and the control of traffic.

While each plant traffic problem requires individual consideration, it is certain that the solution of these problems will be greatly facilitated if the procedures and recommendations cited above are followed as guiding principles.

Figure 3 is a typical layout of plant traffic control including parking, pedestrian and access roadway facilities.

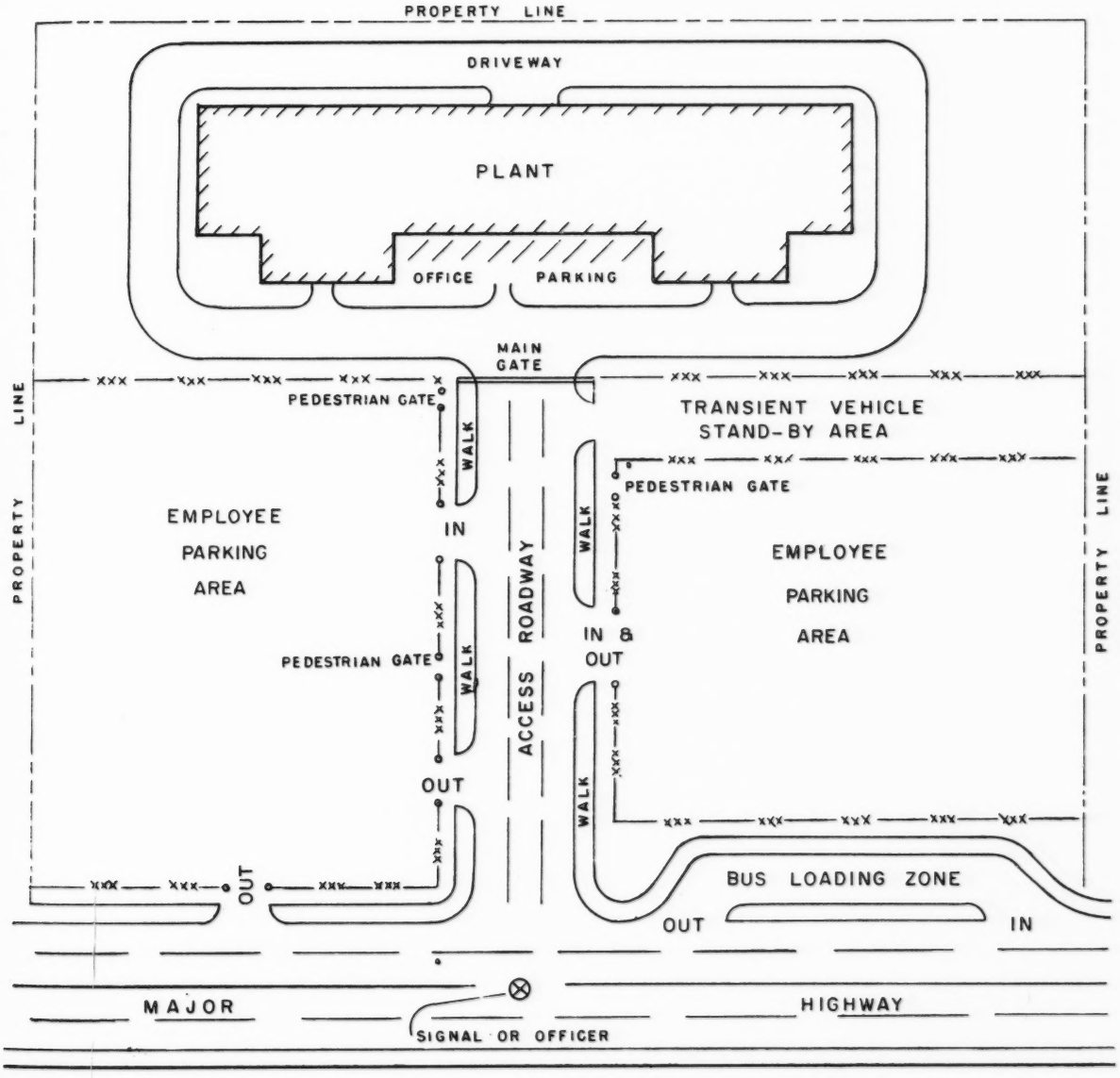
INSTITUTE OF TRAFFIC ENGINEERS
Committee 6-F
Special Use Parking Lots
Membership 1957-58

Charles A. Goodwin, *Chairman* — Traffic & Transportation Engineer, Liberty Mutual Insurance Co., Boston, Mass.

Eugene A. Barton—Chief Traffic Engineer, H. K. Ferguson Co., Cleveland, Ohio

FIGURE 3

TYPICAL PLANT TRAFFIC FACILITIES



Barney A. Cyberski—Traffic Engineer, Michigan State Highway Department, Lansing, Michigan

David B. Martin — Traffic Engineer, Palmer & Baker, Inc., Mobile, Ala.

Armand L. Phaneuf — Liaison Traffic Engineer, Massachusetts Department of Public Works, Boston, Mass.

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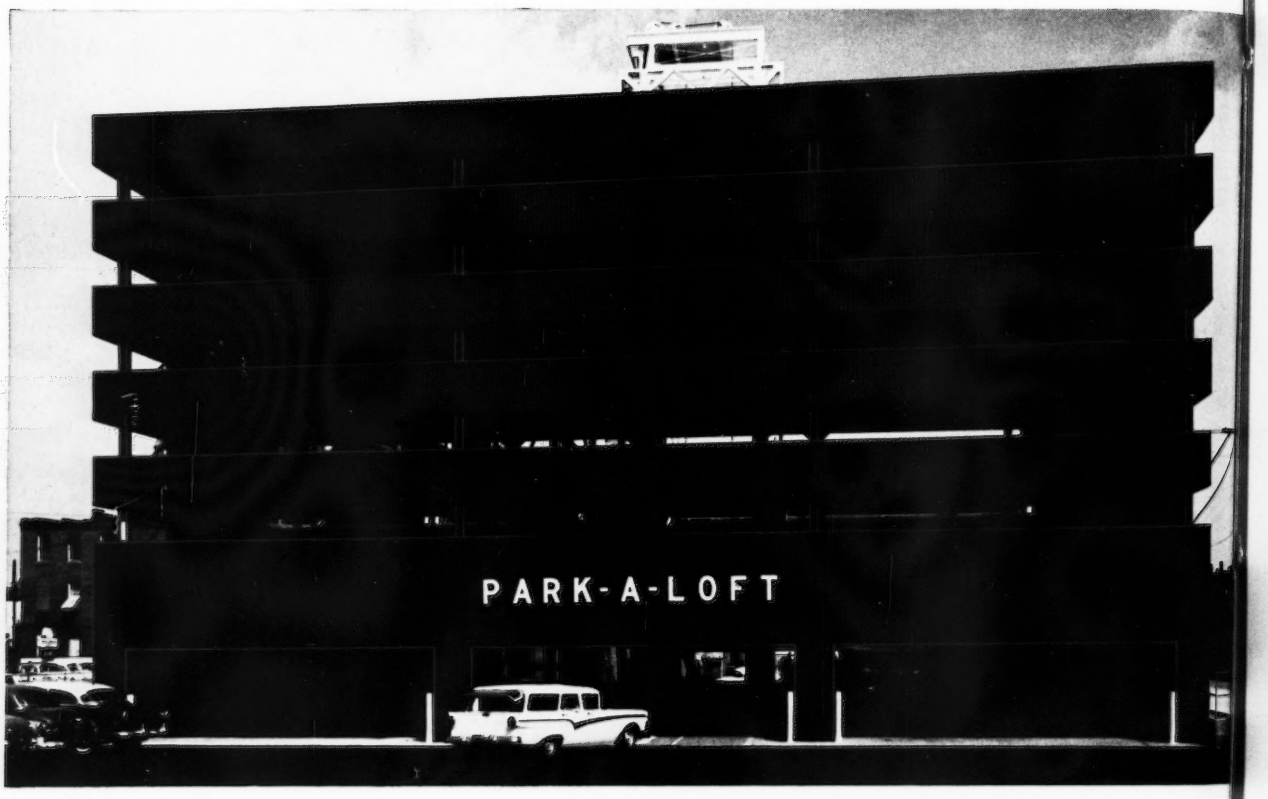

New 264-car Park-A-Loft at Parkersburg, West Va. Frank W. Gove, Jr., Mayor and Chairman of Parking Commission; Jesse D. Folwell, architect; Wilbur Smith & Associates, consulting engineers; Dresser-Ideco Company (Division of Dresser Industries, Inc.), general contractors.

everything that's new in a mechanical parking garage

For the first time, a mechanical parking garage that produces first-floor income, takes traffic surges right off the street

Practically the entire first floor of this Dresser-Ideco "Park-A-Loft" garage in Parkersburg, West Va., produces income. This usable first-floor area is one of the compelling reasons why you should investigate Park-A-Loft. Floor for floor, Park-A-Loft has an unmatched capacity for high-density parking, so essential for efficient use of high-cost, restricted down-town lots. No other mechanical garage has anything like Park-A-Loft's ability to handle traffic surges.

This efficient use of first-floor space comes from Park-A-Loft's unique overhead tower-elevator system. It rides on rails at the second floor level, clears the ground floor of space-wasting elevator travelways. In addition, this two-dimensional tower elevator system saves car handling time. As the elevator carrying a car moves up, the tower *simultaneously* moves horizontally, transporting the car to a previously selected parking stall. This compound movement assures fast handling of vehicles, permits high rate of turnover with minimum crew.

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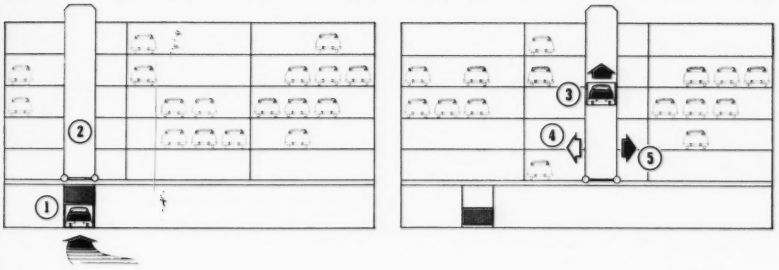
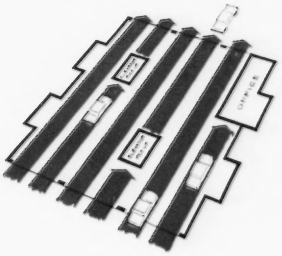
No other mechanical parking garage operates like this . . . or gives this bonus first-floor space.



Park-A-Loft does 2 things at once (left) Car stops in front of elevator station on first floor (1), elevator tower (2) is in position overhead and elevator is on ground floor. Dolly picks up car, carries it onto elevator. (right) As elevator rises into tower (3), wheel-mounted tower **simultaneously** travels either left (4), or right (5) along face of the parking stalls. As tower travels, elevator within tower rises to selected level. At desired parking stall, elevator and tower stop; Park-A-Loft dolly carries car into stall and deposits it. Entire sequence of operations takes only seconds. De-parking operations are just the reverse.



Unmatched reservoir space. Only Park-A-Loft gives you this clear, usable first floor area. Cars can be driven completely through to adjacent parking area, or parked immediately without waiting for mechanical operations.

(left) **No hands.** Car dolly automatically adjusts to the correct length for the car being handled . . . lifts every make and model on rubber-covered pads at these 3 safe points — under both sides of front suspension frame and under differential. There's no metal-to-metal or metal-to-tire contact, no chance of operator error.

(right) **Easiest, safest way to park.** Dolly deposits cars in parking stalls. Right front wheel lock stops any movement. No space is wasted, there's no chance of damage to vehicles.

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Traffic News

England Opens First Freeway Eight Miles Long

The first section of freeway (called "motorway") in Great Britain was recently opened to traffic. Mr. MacMillan, the Prime Minister, opened the eight-mile Preston By-Pass with appropriate ceremonies last December 5. The road is the first link of a projected freeway between London and the northwestern part of the country.

The British Road Federation *Bulletin*, in describing the road and its opening, says:

"Although the dual two-lane carriageways are considered adequate for traffic in the next few years, the motorway is so designed that it may be converted into two three-lane carriageways.

"At the northern end the motorway turns westwards to rejoin the London-Carlisle trunk road A.6. This curve is not a permanent part of the main motorway which will eventually go straight on from Broughton Hall, parallel with A.6. No other curve on the new motorway has a radius of less than half a mile.

"There is one two-level intersection, at Salmesbury, connecting with the Preston-Whalley trunk road, A.59.

"Much thought has been given to the appearance of the road, and a scheme of landscape treatment and tree planting for the whole length of the by-pass has been prepared recently by the Minister's Advisory Committee on Landscape Treatment of Trunk Roads.

"During the next few months the eight-mile Preston Motorway By-pass will be used as a trial length for testing the new motorway signs and regulations and the Motorway Code.

"Construction of the motorway has taken two years five months and has cost about £3,750,000."

The new signs mentioned are illuminated or reflectorized, white on blue background, with upper and lower case letters designed to be read at least 600 feet away. Some of the signs reach a maximum dimension of 20 feet.

Special operating rules, also to be tested, include:

(1) One-way driving on the dual roadways

(2) No stopping

(3) In emergencies, stop only on the shoulder and then no longer than necessary

(4) No backing

(5) No driving on the shoulder or the median

(6) No "learners" on the freeway

(7) No pedestrians

Public Roads Estimates Total Highway Funds at $11 Billion in 1959

Total funds available for highways are expected to reach nearly $11 billion in 1959, according to Bertram D. Tallamy, Federal Highway Administrator. Mr. Tallamy pointed out that this is an increase of 10 per cent over the 1958 total of $9.8 billion, and is largely attributable to increased payments of Federal funds under the expanded Federal highway program.

According to the latest estimates compiled by the Bureau of Public Roads, U.S. Department of Commerce, Federal funds will account for nearly one-third of all highway revenues in 1959, and State road-user taxes and other State income for one-half of the total. Increased receipts in 1959 are anticipated from practically all sources, but the percentage of total revenues furnished by the States and local governments show decreases in 1958 and 1959 as a result of the substantial increase in Federal payments.

Capital expenditures (the cost of right-of-way and construction) are estimated to exceed $7 billion in 1959, a 15-per cent increase over 1958, and will represent more than two-thirds of all direct highway expenditures. Most of the increase is occasioned by expenditures on State-administered highways. Capital expenditures for toll facilities will continue to decline in 1959 as most of them near completion.

A comparison of estimated capital expenditures by all levels of government on the Federal aid and other highway systems for the years 1956-59 is shown below.

Expenditures on the Interstate System are expected to increase from 26 per cent of the total in 1956 to 40 per cent in 1959. Expenditures on the other systems show much smaller increases, and in some instances slight decreases during this period.

Expenditures for maintenance, administration, highway police, and interest on bonds are expected to show further increases in 1959.

Coming Events

March 23-25 — WESTERN SAFETY CONGRESS — Ambassador Hotel, Los Angeles, California. Contact: Joseph M. Kaplan, Greater LA Safety Council, 3388 W. 8th St., LA 5, Calif.

March 31-April 2—PURDUE ROAD SCHOOL (Traffic Engineering Sessions)— Purdue University, Lafayette, Indiana. Contact: H. L. Michael, Civil Engineering Bldg., Purdue University, Lafayette, Indiana.

April 14-16—MICHIGAN SAFETY CONFERENCE Civic Center, Lansing, Michigan. Contact: Gordon H. Sheehe, Highway Traffic Safety Center, M.S.U., East Lansing, Mich.

May 10-14—AMERICAN SOCIETY OF PLANNING OFFICIALS— Annual Conference, Hotel Leamington, Minneapolis, Minn. Contact: ASPO, 1313 East 60th Street, Chicago 37, Ill.

May 26-28—ONTARIO TRAFFIC CONFERENCE CONVENTION— Legion Memorial Hall, Sudbury, Ontario. Contact: R. F. Anderson, 2001 Eglinton Avenue, East, Scarborough, Ontario, Canada.

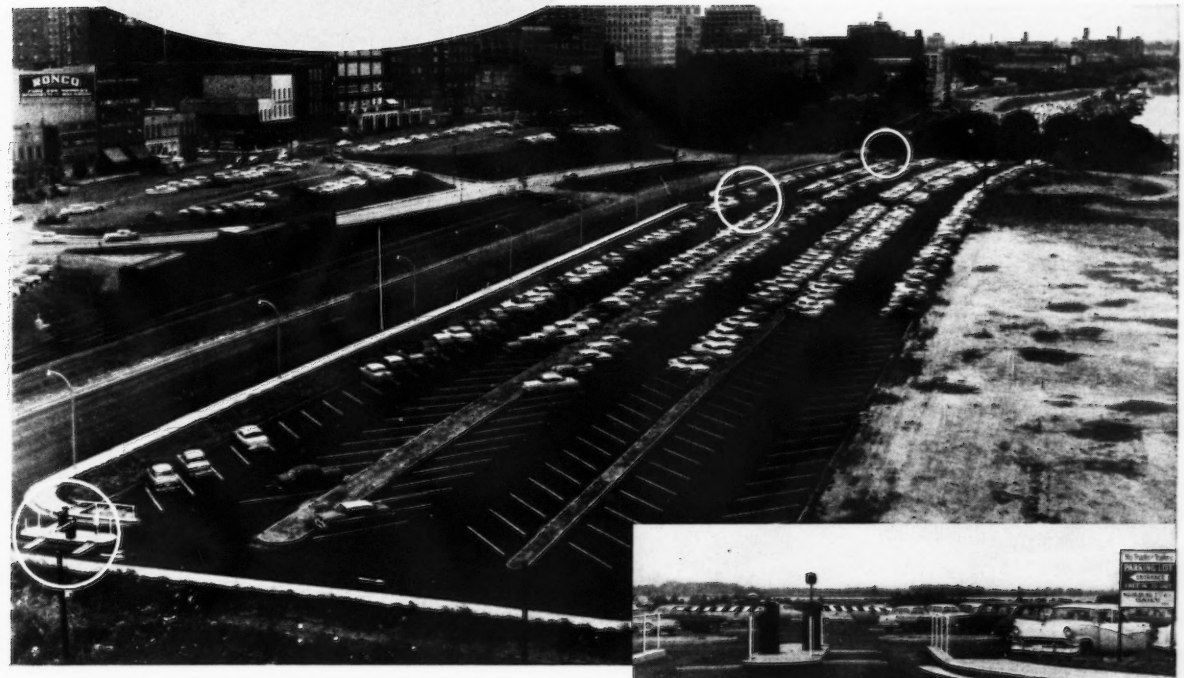
Sept. 14-17—INSTITUTE OF TRAFFIC ENGINEERS 29th Annual Meeting, Commodore Hotel, New York, N. Y. Contact: ITE, 2029 K St. N.W., Washington 6, D. C.

COMPARISON OF ESTIMATED CAPITAL EXPENDITURES
(In millions)

	1956	1957	1958	1959
Interstate System	$1,282	$1,699	$2,189	$2,844
Other Federal-aid systems	2,376	2,498	2,401	2,653
Other State roads	268	245	347	283
Other local roads and streets	980	1,030	1,094	1,160
Not classified	91	133	176	198
Total	$4,997	$5,605	$6,207	$7,138

"...Acceptance beyond our Expectation!"

Memphis parking lot averages 390 cars per day with Western Parking Gates controlled off-street facility!



W. P. HUNTZICKER
Memphis traffic engineer says:

"On July 22, 1958, the City of Memphis opened to public use a 468 car parking lot controlled by three sets of your electric parking gates on a free-in, coin-out basis, with 'Lot-Full' indication at each entrance.

"From the beginning, public acceptance of both the lot and the completely new-to-Memphis means of control has been beyond that expected. This, I believe, is borne out by the fact that daily use has averaged 390 cars during the first 90 days of operation excluding Sundays in that period. It is further borne out by plans to enlarge the present parking lot, and by interest in providing others similarly controlled.

"As with any new piece of equipment, we had to become familiar with the mechanisms. Service calls, never a serious problem, have been virtually eliminated. It is my opinion that the gates have proved themselves completely satisfactory from the standpoint of operation and maintenance.

"The lot is regarded as a distinct asset by downtown workers and merchants, particularly those in close proximity, and it is hoped that others may be developed."

COMPLETE CONTROL WITHOUT PATROL

No attendants are necessary. Not even a cashier is required. Collections can be made once a day by one man in a few minutes. Maintenance and service are reduced to a bare minimum allowing for maximum profit for municipalities, and the highest degree of convenience for motorists. Wire, write or phone for prices and delivery. Send specifications and we'll be glad to submit an installation plan tailored to your needs.

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Engineering Enrollment Down in U. S. First Time In Seven Years

For the first time in seven years, and despite still-critical demands for engineering talent, enrollment in American engineering schools is on the decline.

The 153 accredited American engineering colleges had 2.9 per cent less students in the fall of 1958 than in the fall of 1957. And the freshman class which entered last fall was 11.6 per cent smaller—59,164 instead of 67,071—than 1957.

Declining enrollments have not yet affected the number of engineering graduates — 31,216 in 1957-58 compared with 27,748 the previous year. But the numbers are far short of the record graduation of eight years ago, when World War II veterans were finishing their delayed college careers.

These engineering enrollment figures come from the annual official survey of students and degrees conducted by the American Society for Engineering Education in cooperation with the U. S. Office of Education. Final results were reported today by Justin C. Lewis, Head of Higher Education Statistics, and Dr. Henry Armsby, Chief for Engineering Education, both of the U.S. Office of Education. Fears of dropping engineering enrollments were confirmed by the official figures. Engineering students are now less than 7.7 per cent of all American college students, compared with nearly 8.5 per cent in 1957. Enrollment of second-year students is down 6 per cent from last year, and third-year students are down 4 per cent. Only in the fourth- and fifth-year category does this year's enrollment total as large as last year's. This gives promise of more graduates in June, 1959; but there may be fewer in the years thereafter.

Graduate study in engineering continues to increase sharply, and enrollment is now at record levels, according to the ASEE—Office of Education figures. This fall 27,456 students were enrolled in master's degree programs, an increase of 14.7 per cent over 1957; and 4,762 — up 14.3 per cent — were studying for doctor's degrees.

Last year 5,751 master's degrees were given in engineering, nearly 10 per cent of all master's degrees given in the United States during the year. There were 653 doctor's degrees, 8 per cent of doctor's degrees given in all fields.

Electrical engineering with slightly over 56,000 undergraduate students is by far the most popular engineering field; just over 8,700 bachelor's degrees in electrical engineering were awarded in 1957-58. Next comes mechanical engineering, with nearly 44,000 students and 7,850 graduates. Civil engineering, third in popularity, accounted for just under 15 per cent of the bachelor's degrees, a proportion somewhat lower than in recent years.

Electrical engineering is also most popular among graduate students, with chemical engineering second and mechanical engineering third.

In all, 1,396 women were studying for bachelor's degrees in accredited engineering schools in the fall of 1958, less than 1 per cent of the total enrollment.

All figures released today cover only the 153 American colleges with one or more of their engineering curricula accredited by Engineers Council for Professional Development. In 70 other schools, on which the U.S. Office of Education reports independently of ASEE, there were 39,047 undergraduate engineering students enrolled this fall, and 4,116 degrees were awarded in engineering in 1957-58.

The ASEE report giving statistics by class level in each institution will be in the February 15, Yearbook issue of the *Journal of Engineering Education*. The U.S. Office of Education report giving data in each curricula will be in its Circular No. 555. Both publications will be available about March 1.

Urban County Meeting Scheduled For March 15-18

An estimated 1,000 leaders of the nation's small and large urban counties, joined by hundreds of individuals, associations and institutions concerned with finding solutions to mounting urban area problems, will convene in Washington, D.C. from March 15-18 for an Urban County Congress sponsored by the National Association of County Officials.

The first meeting of its kind ever held, the Urban County Congress is being touted as one of the most important local government meetings to take place in 1959. NACO President W.H."Pat" Johnston of Coweta County, Georgia, himself a commissioner of a once small county fast feeling the sweep of urbanization, has called the meeting "historic." The Urban County Congress will have as its theme, "Practical Solutions to Urban County Problems" and will seek bread-and-butter solutions to specific and complex issues.

Four nationally-known governmental leaders, headed by two United States Senators, will set the tone of the Congress. Senator John F. Kennedy of Massachusetts will speak on County-Federal Cooperation. Senator Frank Carlson of Kansas, who, on his route to the Senate held virtually every public office along the way, will give the needs for County-State Cooperation. Mayor Robert F. Wagner, of New York, chief administrative officer of the world's largest urban complex, will speak on County-City Cooperation. He will bring to the conference an unimaginable wealth of knowledge gained

MOTOR VEHICLE DEATHS AND DEATH RATES

1956, 1957 and 1958

Month	1956	1957	1958	1956-58 Change	1957-58 Change
January	2,954	2,882	2,765	— 6%	— 4%
February	2,652	2,508	2,360	—11%	— 6%
March	2,940	2,843	2,560	—13%	—10%
April	2,970	2,933	2,580	—13%	—12%
May	3,094	3,065	3,005	— 3%	— 2%
June	3,338	3,302	3,005	—10%	— 9%
July	3,555	3,308	3,210	—10%	— 3%
August	3,535	3,635	3,455	— 2%	— 5%
September	3,653	3,365	3,330	— 9%	— 1%
October	3,476	3,466	3,580	+ 3%	+ 3%
November	3,603	3,620	3,490	— 3%	— 4%
December	3,858	3,775	3,660	— 5%	— 3%
Total	39,628	38,702	37,000	— 7%	— 4%

All 1956 figures in the table above are from the National Office of Vital Statistics.
All others are National Safety Council estimates.

Here's help for

HIGHWAY PLANNERS

Monotube poles, piles and overhead sign supports, used on many of the nation's leading highways, help provide increased driver safety, improved traffic flow, and economy in various phases of highway construction.

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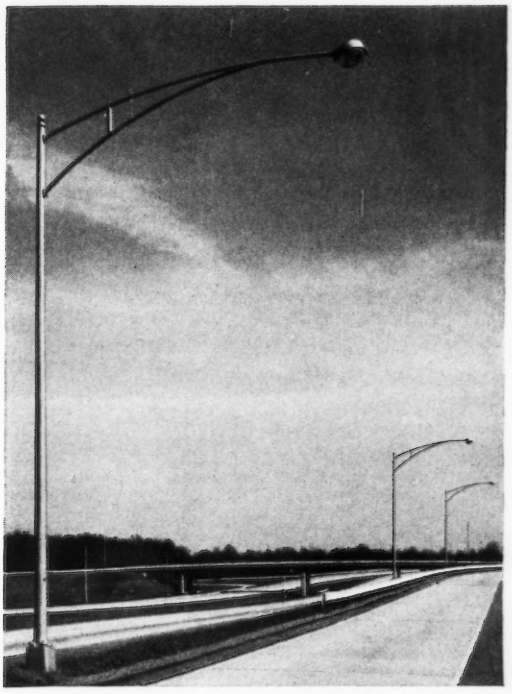
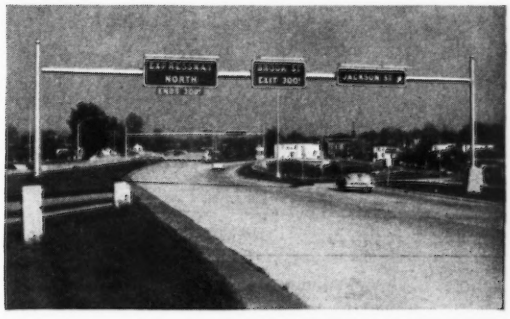
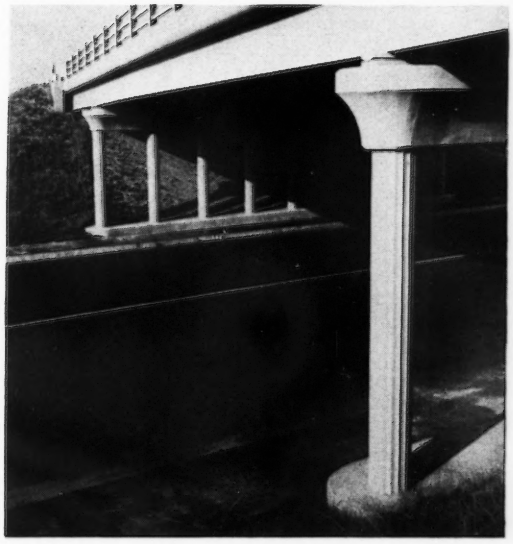


MONOTUBE LIGHTING POLES



MONOTUBE SIGN SUPPORTS



MONOTUBE FOUNDATION PILES

from working with a metropolitan area spread over three states, eleven counties and innumerable towns and cities.

Inter-County Cooperation will be discussed by Edward Connor, Supervisor of Wayne County, Michigan. He is one of the recognized national leaders in the field of multi-lateral cooperation and planning among local governing bodies.

General Conference Chairman is Judge C. Beverly Briley, of Davidson County, Tenn., Chairman of NACO's Urban Areas Committee and presiding officer of one of the most progressive urban counties in the South.

In a Congress dedicated to finding practical solutions to stressing problems, the accent will be upon discussion groups, each headed by an authoritative discussion leader. There will be six of these, and they in turn will be broken down into three closely related panels. The discussion groups will cover the fields of Urban Transportation, County Administration, Social Welfare, County Finance, Community Facilities, and County Planning. Each will be explored in all its ramifications, touching upon virtually every aspect of American urban living.

The Urban County Congress will be a milestone in local government administration and the attempts to combat the "urban problem" because it will bring about a free and abundant exchange of information among those closest to the problem, the actual governmental officials concerned. More and more the "urban problem" has become the county problem because by its very nature urban development has overflowed the rigid yet artificial barriers of city limits, spilling into the adjacent counties who have inherited many new services which they sometimes have not had the legal, administrative or financial machinery to handle. Their awakening in the face of this challenge has been one of the amazing phenomena on the American scene.

Training Opportunities

April 15-17—FREEWAY OPERATIONS SEMINAR
A seminar will be held at the Moraine Hotel, Highland Park, Illinois, under the sponsorship of the Midwest Section. Planners, engineers and enforcement officials who are or will be responsible for the planning, design or operation of controlled access facilities are invited. For reservation forms and further information, contact George Hagenauer, Illinois Division of Highways, 160 N. LaSalle Street, Chicago 1, Illinois.

April 20-22—FREEWAY OPERATIONS SEMINAR
A seminar will be held at the Town House, near Omaha, Nebraska, under the sponsorship of the Missouri Valley Section. Planners, engineers, and enforcement officials who are or will be responsible for the planning, design or operation of controlled access facilities are invited. For reservation forms and further information, contact Robert L. Meyer, Department of Roads, State Capitol, Lincoln, Nebraska.

May 11-13—FREEWAY OPERATIONS SEMINAR
A seminar will be held at Bear Mountain State Park, New York, under the sponsorship of the Metropolitan (N.Y.) Section of the Institute of Traffic Engineers. Planners, engineers, traffic enforcement officials and others who have or will have traffic operations responsibilities for freeways are invited. Attendance will be drawn primarily from the New York City metropolitan area, and the program will be slanted toward problems of urban freeways. For reservation forms and further information, address Gordon K. Gravelle, Deputy Commissioner of Traffic, 100 Gold Street, New York 38, N.Y.

June 8-19 — TRAFFIC ENGINEERING AND POLICE ENFORCEMENT COURSE—
This course is an annual one offered by the Ontario Traffic Conference, and is scheduled this year at Huron College, University of Western Ontario, London, Ontario. For information, contact R. F. Anderson, Traffic Engineering Dept., 2001 Eglinton Avenue, East, Scarborough, Ontario, Canada.

HAVE YOU MADE A CHANGE?

If you have moved or changed jobs, please tell us about it.

Title ..... (Position) ..... (Branch)

Organization .....

☐ **Address** ..... (No.) ..... (Street)

City ..... (City) ..... (Zone) ..... (State)

Telephone ..... (Spell Out Exchange)

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New Publications

The Utilization of Freeway Bus Stops in Los Angeles

Supplement to Research Report No. 28, "The Utilization of Freeways by Urban Transit Buses: A Nationwide Survey." The Institute of Transportation and Traffic Engineering, University of California, Berkeley, California. 7 pp.

This supplement adds to the original report the results of a study made in the Los Angeles area. Although the authors point out that the unique geography of the area may make the study inapplicable to all other urban areas, they suggest that freeway bus stops can serve a useful purpose by providing transfer points to cross-town routes outside the CBD, serving both inbound and outbound traffic.

Relationship Between Vehicle Characteristics and Highway Design—A Symposium

Bulletin 195. Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C. November 1958. 48 pp. $1.00

This bulletin contains seven papers presented at the 37th Annual HRB Meeting on three topics of mutual interest to automobile manufacturers and highway engineers.

"Driver Eye Height and Vehicle Performance in Relation to Crest Sight Distance and Length of No-Passing Zones" is presented from the following three viewpoints:

"Vehicle Data," by K. A. Stonex.

"Vertical Curve Design," by D. W. Loutzenheiser and E. R. Haile, Jr.

"Driver Passing Practices," by O. K. Normann.

"Passenger Car Overhang and Underclearance as Related to Driveway Profile Design" is discussed from the viewpoint of "Vehicle Data" by W. A. McConnell and from the viewpoint of "Street and Highway Design" by L. A. Bauer.

The subject of "Passenger Car Dimensions as Related to Parking Space" is presented by L. H. Nagler and William R. Froehlich, who discuss it from the viewpoints of "Vehicle Data" and "Parking Facility Design," respectively.

New Appointments

Gilliss Becomes L. A. County Roads Commissioner

C. M. "Max" Gilliss, (Affiliate, ITE) formerly Director of the State Department of Public Works and Chairman of the California Highway Commission, became Road Commissioner of Los Angeles County on November 1, 1958.

C. M. "Max" Gilliss

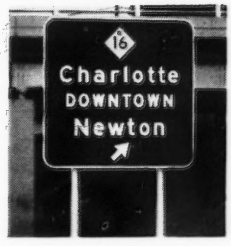
Mr. Gilliss has held highway and public administration positions for the past twelve years. Prior to entering public administration work, he was with International Business Machines Corporation as an Engineering Instructor and Sales Engineer. He entered his career in road administration in 1947, when he was appointed Assistant Road Commissioner and Highways Administrator for Riverside County. He went into state service from Riverside County in 1952 to become Special Representative for the Director of the State Department of Public Works, advancing to Assistant Deputy Director in 1953 and Deputy Director in 1955.

In 1957, Mr. Gilliss served as Legislative Staff Secretary for Governor Goodwin J. Knight. He returned to the Department of Public Works as Director on January 1, 1958. He was at that time the youngest Director of any state department and Director of the largest state department. The California Department of Public Works is the largest department of its kind in the world, having 14,000 employees and a current budget of $750,000,000.

In his present position, Mr. Gilliss will direct the activities of a department serving a population of 5,500,000 in an area having a motor vehicle registration of 2,750,000. The Los Angeles County Road Department maintains over 4,000 miles of roads and has contracts with 17 incorporated cities to perform various engineering services. The current budget for the Department is $42,500,000. Mr. Gilliss stated in his letter of resignation as Director of the Department of Public Works "I could not refuse the challenging opportunity to reorganize and direct the affairs of the road department of the most populous county in the United States, a county with a larger budget than three-fourths of our states."

In addition to holding an Affiliate membership in the Institute of Traffic Engineers, Mr. Gillis is affiliated with the American Society of Civil Engineers, American Road Builder's Association, American Right-of-Way Association, American Society for Public Administrators, Western Governmental Association, American Public Works Association and International Accountants Society.

"Cuts maintenance to the bone"



PACKAGED SIGNS
SPEED INSTALLATION

To the natural advantage of light weight, Tassco provides these aluminum signs in pre-arranged packages ready for installation. The easy-to-handle panels are assembled on the job site and mounted in a matter of minutes.

TASSCO

This is North Carolina's new Route 85, by-passing cities, moving traffic quickly with the help of a signing program by Tassco. The complete program consists of ground mounted and overhead signs. The signs themselves are increment sheet signs developed by Tassco especially for use on modern, high-speed roads. They can be had in any height or width and are designed to meet 100 mph wind loads. The use of increment sheets means new lows in the cost of both materials and installation. But what is most important, since the State has to bear the costs of maintenance, is that with 1193 signs, 501 sign supports, and with 9 large sign spans, not one drop of paint is required for maintenance.

North Carolina's signs feature the approved reflectorized green background with white AGA letters. However, reflective material or painted backgrounds are available in any type letters or symbols.

Helpful data, including a full color movie, is available from the Tassco-P & K Highway Planning Committee. Write for "Committee Data" today.

TRAFFIC AND STREET SIGN COMPANY
84 FOUNDRY STREET, NEWARK, N.J.

NEW

P&K 30-FOOT ALUMINUM TRUSS ARM

P & K IS ALWAYS FIRST WITH NEW IDEAS

James Colombo of Traffic Control Equipment Corp. Hackensack, N. J., P & K distributor:

This new Yonkers installation, one of my most recent jobs, is the type of progressive engineering I've come to expect from P & K. Naturally, as specialists in the design of traffic signal standards and spans, they are always at work, not merely keeping pace with traffic problems, but anticipating the requirements of traffic engineers everywhere.

controls wide intersection

The photo above shows the busiest intersection in the city of Yonkers, modernized with a 5-lens signal-head. That's right—a 188-pound signal-head extends over this wide intersection supported by a modern 30-foot P & K aluminum truss-type-arm traffic signal standard. It's another first for P & K! Designed to speed traffic and reduce accidents, this new installation has done both!

And, *as a bonus in advance*, Yonkers enjoyed the advantage of simplicity of installation. After all, P & K aluminum standards and truss arms, though exceptionally strong, are light in weight. What's more, this modern unit never needs painting—will keep its good looks for years to come—a credit to the good judgment of the traffic engineers who selected it.

For more facts on this new 30-foot arm and the many other traffic signal and sign standards and spans made by P & K, write for Brochure TE-1.

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BRANCH SALES OFFICES: MIAMI, FLORIDA; BURLINGAME, CALIFORNIA
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Hallock Joins Staff Of Harrisburg Consulting Firm

Houghton R. Hallock has joined the Consulting Engineering firm of Gannett Fleming Corddry and Carpenter, Inc. in Harrisburg, Pennsylvania as Director of the General Engineering Division. He recently resigned from his position of Executive Vice-President of the Texas Atomic Energy Research Foundation. Previously he had retired as a Colonel from the Corps of Engineers, U.S. Army, after twenty years service. His Army service included engineering and construction assignments in Europe, Greenland, Hawaii and Okinawa, as well as three years as District Engineer in the Corps of Engineers in Fort Worth, Texas.

Houghton R. Hallock

Fennell Retires from KC Public Service Co. After 54 Years

Dan L. Fennell (Affiliate, ITE) retired on February 1 from the Kansas City Public Service Company after 54 years in the transit field. From his first job as a rodman, he moved through the ranks to the position of vice president. For the past several years he has held the title of vice president in charge of public relations.

Together with other citizens and officials he was responsible for bringing Dr. Miller McClintock to Kansas City many years ago for a traffic survey—a project which in turn resulted in the formation of the Kansas City Traffic Engineering Department.

Active in the work of the American Transit Association, Mr. Fennell helped organize the Accident Prevention Committee of the ATA, and served for a number of years as chairman. He held various offices over the years in both the American Transit Association and the National Safety Council, and is well known in both organizations.

JOB CHANGES

Robert B. Campbell — from the Ontario Department of Highways in Toronto to the Department of Transport in Ottawa.

Vincent M. Cangiano—formerly with P. W. Genovese & Associates in New Haven; now Traffic and Highway Engineer with Charles A. Maguire & Associates at Wethersfield, Conn.

William J. Dabel—from the position of City Manager of Benicia, California to Berkeley as Supervising Civil Engineer of the Public Works Department.

Arthur R. Daniel, Jr.—from the Ohio Department of Highways in Marietta to the North Carolina State Highway Commission in Raleigh as Area Traffic Engineer.

John B. Ecker—now a Consulting Engineer in Princeton, New Jersey; was previously associated with W. C. Gilman & Company in New York City.

Maxwell N. Halsey—formerly with the Eno Foundation in Saugatuck, Connecticut; now a Traffic Consultant in Norwalk.

James R. Halverson — from the Utah Road Commission in Salt Lake City to the position of Government Trades Sales Representative for the Minnesota Mining and Manufacturing Company's Reflective Products Division. He will remain in Salt Lake City.

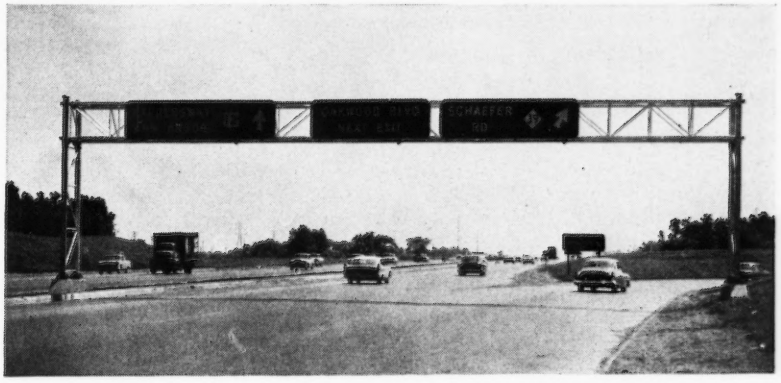
Keneth M. Hoover—is now Chief Engineer of the San Francisco Rapid Transit District; was a Traffic Consultant in Sutton, Massachusetts.

Charles M. Noble—formerly with the Ohio Department of Highways in Columbus; now a Consulting Engineer in Princeton, New Jersey.

TITLE CHANGES

Stanley M. Lanham—was Vice-President of the Los Angeles Transit Lines; is now Director of Planning for the Los Angeles Metropolitan Transit Authority.

James E. Coleman—is now Chief of the Transportability and Engineering Division, the Office of the Chief of Transportation, Department of



WANTED: Representatives for PLANET HIGHWAY SIGN STRUCTURES

Planet Corporation, a leading supplier of engineered handling systems and automated machinery, is expanding its sales area for its overhead and roadside sign structures. Planet all-aluminum sign structures are expertly designed by experienced engineers. They will withstand hurricane-force winds, can be erected with minimum traffic interference, and eliminate maintenance costs. Planet sign structures are in use on highways in Michigan and Kentucky, and are under construction in others.

Now Planet needs representation in a number of states for this profitable line. If you would like to become associated with this progressive, growing company on either a full or part-time commission basis, write: Personnel Director, Planet Corporation, 1842 Sunset Ave., Lansing, Michigan.

PLANET CORPORATION

• TRAFFIC & SAFETY EQUIPMENT
• ENGINEERED HANDLING SYSTEMS
• AUTOMATION EQUIPMENT

the Army, in Washington, with the rank of Major.

Robert A. Keith — in addition to his duties as Traffic Engineer with the National Capitol Planning Commission in Washington, he will serve for several months as Acting Project Director of the Mass Transportation Survey.

Urban Land Institute Elects Officers for 1959

At a recent meeting in San Antonio, the Urban Land Institute elected officers for 1959. Re-elected president was David D. Bohannon of San Mateo, California.

Among other officers and trustees elected was Harley L. Swift (Mem. ITE), named to the Board of Trustees.

The ULI is an independent research organization specializing in urban planning and development. It maintains three 25-man councils of business leaders and urban specialists which are concerned with the various aspects of urban land use. These are the Central Business District Council, the Industrial Council, and the Community Builders' Council, and their services are frequently sought to study the problems of a specific city, area or development.

Strictly Business

Shown above is one of the sign spans erected on the approaches to the Baltimore Bay Tunnel under the direction of the Maryland State Highway Department. The particular span shown is a 100 foot box truss made entirely of aluminum. It spans the complete multiple lane roadway plus the shoulders on both sides. This application has taken advantage of aluminum's light weight to permit a relatively wide span without a center support. Yet, the unit is sturdy enough to withstand 100 mph wind loads. Another important factor is that the aluminum span requires no painting at any time. The span was fabricated by Pfaff & Kendall and the entire signing program was supplied by Traffic and Street Sign Company, Newark, New Jersey.

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Since 1922

America's Largest Manufacturer of Sign Blanks and Signs
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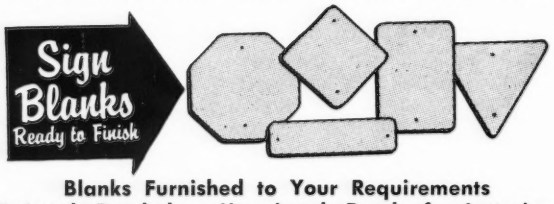

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— Painted, Beaded or Unpainted, Ready for Lettering —

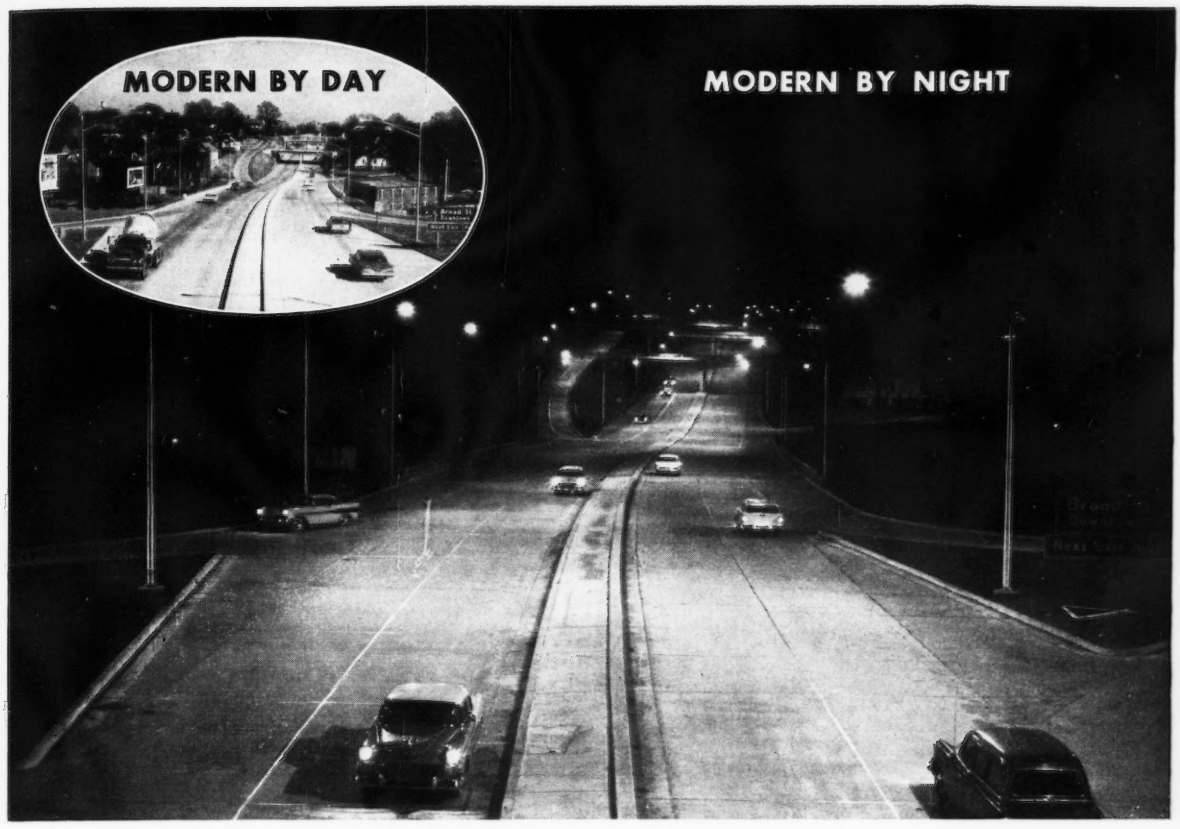
Few of many hundreds of customers: States and Thruways of Alabama, Mississippi New York, Arkansas, Pennsylvania, Virginia, etc., etc.

Let Us Quote on Your Requirements of Standard or Special Sign Blanks and Signs.

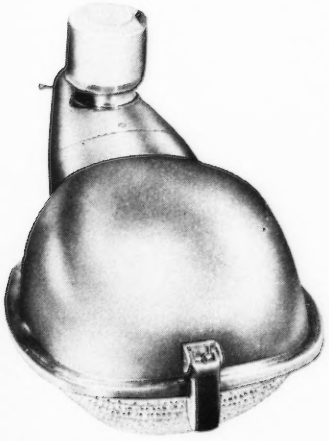
MUNICIPAL STREET SIGN CO., INC.
College Point, Long Island, New York

Magnetic Detector Introduced by Southern Signals

Southern Signals, Inc. has introduced a completely new type of surface mounted magnetic detector for vehicle actuated signal control installations. Autoflow Surface Model 242 Magnetic Detector is designed to be installed with the top surface of detector flush with the roadway surface and located in the center of a single traffic lane. This location insures maximum efficiency of vehicle detection over a wide speed range. This highly sensitive unit is completely sealed and unaffected by moisture, creating no replacement problem since there is no aging or wear, according to the manufacturer. Only a small cavity in street surface is necessary to receive the detector for installation.



Modern light on Winston-Salem Interstate link makes nighttime driving as safe as daytime



AMERICA'S LEADING LINE of highway lighting equipment is ready to help you cut our nighttime traffic toll. Count, too, on expert application help from G-E lighting engineers at your nearby G-E Apparatus Sales Office.

North Carolina's first Interstate mileage—a 3.1-mile stretch of Route 40 opened in Winston-Salem more than a year ago—is lighted for its entire length. In specifying modern roadway lighting, North Carolina Highway Engineers made the "Winston-Salem Expressway" as safe, convenient, and efficient a traffic carrier by night as it is by day. This is an opportunity —and challenge—open to every state.

America's annual nighttime traffic toll adds up to 20,000 deaths—nearly a million injured—close to two-billion dollars in cost to business and individuals. Experts agree that such slaughter and economic waste can be *cut in half* by modern roadway lighting.

And it isn't necessary to light every mile of roadway! The job can be done by concentrating on *seven deadly areas of driver decision:* entrances and exits, bridges and viaducts, intersections, underpasses and tunnels, interchanges, guide-sign locations, and heavily travelled stretches. Cost of such lighting is low—on the average close to 1% of total highway cost. Operation runs less than grass cutting and similar day-to-day maintenance.

Measured in terms of human safety, driver convenience, and traffic-carrying efficiency, a new highway without proper lighting is out of date the day it is opened. Make sure that all new highway mileage in your state is up-to-the-minute—by night as well as by day! General Electric Co., Outdoor Lighting Dept., Hendersonville, N. C. 450-9

Progress Is Our Most Important Product

GENERAL ELECTRIC

Aluminum Guard Rail Offered by Alcoa

A complete all-aluminum highway guard rail system, engineered to assure rapid installation and freedom from maintenance, was introduced today by Aluminum Company of America.

Said to be the world's first, it is formed from high-strength Alclad alloy, and features a coating of high-purity aluminum for ultimate protection from corrosion. It will never require painting, Alcoa says.

Available in three thicknesses, the guard rail panels measure 12¼-inches wide and 3¼-inches deep. Standard panels are 13½-feet long. The lustrous 2024 - T3 Alclad finish will remain highly visible, even in unusually corrosive atmospheres, according to the manufacturer.

Competitive in cost with existing railing systems of other materials, the aluminum guard rail is said to offer advantages to both owners and installers. Fabricated from sheet covered by ASTM specifications, it is designed to be interchangeable with other systems and can be mounted on all types of posts.

Made from 0.105, 0.125 and 0.156" stock, Alcoa Aluminum Beam Guard Rail features joint tensile strengths of 65,000, 80,000 and 100,000 pounds respectively. Performance data is based on results of independent, extensive tests by the Pittsburgh Testing Laboratory, Pittsburgh, Pa.

A choice of terminal sections is available with the new Alcoa system. In addition to the traditional "flared" end, curved and median terminals are also being offered.

A complete all-aluminum fastening system makes possible rapid erection by the contractor. Although the rail boasts high strength, individual sections weigh but 40 pounds, and can be handled easily by one workman.

Specifications call for the rail to be installed on conventional 12½ - foot centers. Splices will be 12½-inches. Aluminum bolts are used for laps, and to fasten the system to posts.

Complete information and suggested specifications for Alcoa Aluminum Beam Guard Rail are available from any Alcoa sales offices, or from 767, Alcoa Building, Pittsburgh 19, Pa.

Cataphote Corporation Announces Changes In Executive Line-up

The promotion of two key executives has been announced by Charles E. Searight, vice president, Cataphote Corporation of Jackson, Mississippi.

Jack E. Fagala becomes general manager of the Mississippi traffic control products manufacturer and William L. Lowry is promoted to sales manager

Fagala, a graduate of the University of Indiana, has been associated with the firm for the past four years. He was formerly division manager responsible for manufacturing operations.

Lowry, the new sales manager, has been with the company for five years.

In the demonstration above, you see an unretouched photo of a Lyle Sign bent 160 degrees. By magnification, you see that the resilient enamel baked on by Lyle shows no cracking or marring whatsoever!

ANOTHER PROOF OF
LYLE'S SIGN QUALITY

Torture test shows how Lyle sign finishes resist fractures in extreme bending.

All outdoor signs are exposed to abuse. That's why Lyle Sign Engineers demand — and get — perfection in the baked enamel finish on Lyle Signs. In the most modern, electronically controlled ovens, Lyle Signs are baked at *exact* temperatures for *precise* periods of time. And, of course, Lyle Signs are clad only in the finest baking enamels available.

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Automation on Illinois Tollway... will reduce auditing costs, speed traffic

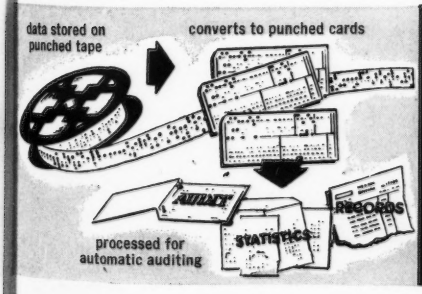
When the magnificent new Illinois Tollway is completed, the advanced toll collection system by Electronic Signal Company will save man-hours, cut auditing costs, and speed traffic. Special features of this new system are the world's first punch tape recorder, automatic charge transactions, and automatic toll collectors.

To see how these and other new ideas by Electronic Signal can improve toll collection for you, write today for information.

Electronic Signal punch tape recorder ...stores all the toll collection data from a plaza on punched tape, which is sent to a centralized accounting facility and automatically converted to punched tabulating cards. Business machines then turn out a complete audit, statistics, and invoices in a fraction of the time required for manual computation. Modern, flexible, dependable... it will pay its own way! *Ask for bulletin No. 116.*

Automatic charge transactions... the driver hands the toll collector a punched, coded plate which is inserted in the new Electronic Signal charge plate system. In a fraction of a second the entire transaction is recorded on punched tape for automatic billing. Result... a toll facility can speed up traffic flow and also attract extra revenue by offering rapid, low-cost charge account processing. *Ask for bulletins No. 102 and 112.*

Electronic Signal Automatic toll collector ...will pay for itself in a surprisingly short time! Not only does it eliminate the need for an attendant in the lane, but it also speeds traffic and completely protects the revenue. Many advanced features... self-starting, non-jamming counting cycle with unmatched speed... maximum security vaults... weather-proof housing... automatic moisture control ...and many others. *Ask for bulletin No. 115.*



ELECTRONIC SIGNAL CO., INC.

A SUBSIDIARY OF NEPTUNE METER COMPANY

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neptune

Spun Concrete Poles to Be Made By St. Louis Firm

Spunco Products, Inc., 4623 Chippewa St., St. Louis, Mo., has been granted a franchise to manufacture centrifically spun concrete lighting standards, transmission poles, sewer and pressure pipes, conical and cylindrical piling, road guards, columns, anchoring and terminal poles.

Mr. C. W. Deffenbaugh, president of the company, states the factory, which is the first with Betoma equipment in the United States, will soon be in full production.

The patented equipment used in the fabrication of Spun Concrete Products is imported from Germany. This equipment and formula was developed by Dr. O. Meyer over a half a century ago. Since that time, hundreds of thousands of Spun Concrete Products have been in use throughout the world.

Graphic testimonial to the durability of poles and pressure pipe is the fact that without benefit of maintenance in all types of climates, soil, water or acid attack, practically no deterioration can be found, according to the company.

Lighting standards are available in standard and custom design to fit any architectural style. Poles are fabricated with holes, slots and openings to specification.

Transmission poles are fabricated in lengths up to 105 feet. Tests reveal centrifically spun concrete poles have great strength plus extreme flexibility. For example, a 60 foot pole with a top diameter of 5″ computed for a tensile load at the top of 440 lbs., can be stressed four or five times and thrust 3 feet out of its axial line and then return to a straight line when stress is released without changing shape or exhibiting any cracks or fissures in its body.

Transistorized Flasher Produced by Denver Firm for Road Use

A new 7″ transistorized flashing light for large construction and runway jobs has been developed by Traffic Equipment Company of Denver, Colorado. The large specially designed high impact plastic lens and the longer, slower flash (50 to 60 per minute) gives better warning to motorists approaching at higher speeds, according to the manufacturer.

The lens design has an exclusive reflector ring at the outside which produces added brilliance when car lights strike the lens. The self-contained transistorized electronic flashing unit is said to be virtually indestructible and has an unconditional guarantee against component failure. The entire unit is waterproof, vaporproof and will operate continuously off its six-volt battery for 2200 hours. The built in switch is tamperproof.

The 7″ Sentry light (Model SFL-67) is known as "The Commander" while the 4″ Model SFL-64 is known as "The Vigilant." The smaller conventional flash is identical with the larger unit except in lens design and diameter.

Full details on the flashing lights and on the complete line of all-steel Sentry barricades are available from the firm at 2064 South Bannock Street, Denver 23, Colorado.

Western Industries, Inc. Buys Fred EX Enterprises

George L. Hudson, president of Western Industries, Inc., Chicago, has announced the purchase of Fred EX Enterprises, manufacturers of a complete line of safety parking barriers.

The entire operation of Fred EX Enterprises, including manufacturing facilities and inventory has been moved to the Western Industries plant at 2742 West 36th Place, Chicago where it will become a part of the Electric Parking Gate Division.

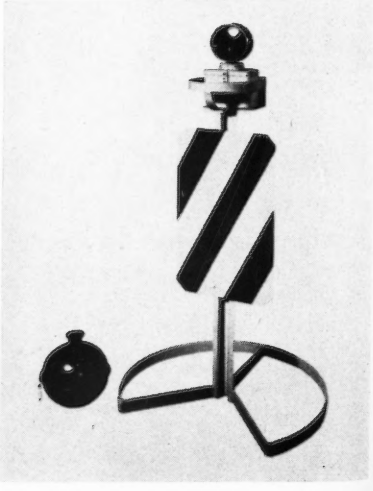
Dietz Introduces New Hazard Warning Light Stand

Designed to hold torches or flashers, this new hazard warning stand can be used in place of barricades, especially where space is restricted, and to elevate lights or torches along the approach path to a hazard. Stands with lights can be arranged in series to provide emergency or temporary barricades.

The top platform unit will accommodate either torches or flashers for night-time or inclement-weather warning. The stand also features a warning shield for daylight warning; the diagonal striped shield is 12″ wide, 20″ high.

The stand, 38½ inches in height, is finished in beacon yellow and black. The circular base, 24 inches in diameter, has a wide-angle "pie-cut" to facilitate stacking. Stand weighs 20 pounds.

For further information, write Hazard Warning Lighting Division, R. E. Dietz Company, 221 Wilkinson Street, Syracuse 1, New York.



NOTICE

Effective March 1, 1959 the subscription rate for TRAFFIC ENGINEERING magazine is $4.50 a year (foreign postage $1.25 extra).

Increased operating expenses are responsible for this price rise. We wish it were not necessary, but we will point out that it is the first increase since 1949.

—the Editors

New Paint Offered For Use on Rubber Cones

Rubber traffic cones often become dirty or paint-chipped, making them not only disreputable in appearance but difficult to see at night or under unfavorable weather conditions.

For some years a New Jersey firm has manufactured a solvent-thermoplastic elastomer base paint that is widely used for decorating various types of rubber and dries to a flexible finish. Now this paint has been modified so that it is ready for outside use on traffic cones. Unlike conventional paints, it will not chip off when flexed, stretched or under impact, according to the maker. Extremely flexible, it will not discolor under heat or light and offers ozone resistance to protect the rubber from weathering and deterioration.

Vanflex may be applied by brush—it covers well with one coat. If a large number of cones are to be repainted, the manufacturer suggests Vanflex be applied by spraying or dipping. For these applications, Vanflex may be reduced 50 per cent with Vanflex Thinner #22. For all applications, it is best that the old finish be cleaned and completely removed if possible with Thinner #22 or paint remover.

Vanflex Traffic Cone Paints are supplied in 5 gallon pails and 1 gallon cans, in yellow, red and black. For prices and more information, write: Vansul Colors, 183 William Street, Englewood, New Jersey.

(Continued on page 61)

Section News

OHIO SECTION

A stepped-up, more active participation in Section, District and National I. T. E. programs is being planned for the Ohio Section. Among the immediate projects to receive greater attention are:

1. *SECTION LEVEL*
   (a) Development of a Legislative Program and obtaining State Legislators' cooperation.
   (b) Greater Section participation on I. T. E. Technical Committees.
2. *DISTRICT LEVEL*
   (a) Develop greater District cooperation with a closer active tie among its 4 Sections.
   (b) More and better District meetings. Shall Potowatomi (Indiana) continue as regular meeting place or shall meetings be rotated to all Sections.
3. *NATIONAL LEVEL*
   (a) Section participation in I. T. E. Workshop Conference, to be held in Chicago late in May.
   (b) How can our Section help strengthen aims and accomplishments of the I. T. E. Technical Council.

MICHIGAN SECTION

Our first 1959 meeting was held Wednesday, January 21, in Jackson, Michigan. The weatherman really did his best to prevent this one by tossing rain, sleet and snow at most of the members daring to venture out. However, the meeting was held and a substantially good turnout was counted.

Retiring President, Al Hayes, gave us an interesting documentary report of the I.T.E. Annual Miami convention with special emphasis on the business meeting and elections.

A list of the 1958 and 1959 Section Officers is shown below:

1958 Officers
Alan Hayes, President
Wm. Marvin, Vice President
Russell Harrison, Secretary-Treasurer

1959 Officers
Wm. Marvin, President
Russell Harrison, Vice President
Max Hoffman, Secretary-Treasurer

A most interesting speaker, Mr. Peter Hurst, President of Aeroquip Corporation talked of his trip to Russia and showed movies. Highlights of his presentation were those sections on traffic, industry and universities in Russia.

CANADIAN SECTION

1958-1959 Executive
President—A. Lomax
Vice President—W. F. Finnbogason
Sec.-Treasurer—G. A. Bacchus
Eastern Director—J. Barriere
Central Director—A. J. Freedman
Western Director—D. D. Kuchinski
Past-President—S. Cass

Obituary

As most of our members probably know, Mr. Ken Siddall died suddenly while attending the I. T. E. Convention at Miami Beach. He was one of the first to realize the importance of Traffic Engineering and gave a tremendous amount of encouragement to many of our members, both inside the Department and in other agencies. We would like to express the sympathy of the Canadian Section to his family.

NEW MEMBERS

Since the publication of the last newsletter the following persons have become members of the Institute, and we are pleased to offer our congratulations to them.

K. P. Furness (Assoc.)
R. J. Genereux (Assoc.)
Morris Rotman (Junior)
K. E. Thompson (Junior)
J. M. Taylor (Section Affiliate)
J. Tweddle (Section Affiliate)

Position Changes

Our congratulations to John Wilkes on his appointment as Planning Engineer of the Ontario Department of Highways.

Our very best wishes to Bob Campbell who is now working with the Department of Transport in Ottawa and to Doug McFarlane who has started on the Ontario Department of Highways Training Course for Engineers.

WESTERN SECTION

Washington Area

A traffic analysis study of a proposed Seattle Expressway network has reached the halfway point. This joint State-City project is under the joint direction of Bob Dunn and Bruce Culver. Direct supervision of the personnel engaged in this study falls upon Bernie Cook's shoulders. The information from five separate O and D Surveys was consolidated and brought to a common base year for expansion to the year 1985 by this crew.

Speaking of traffic surveys, the ground work has been laid to determine if a comprehensive transportation survey is justified in the Seattle Area. The State, County, City and City Transit System have each contributed to a preliminary survey which is presently being conducted by consultants. Our good friend Russ Bates has been active in this survey.

The first short course in Traffic Engineering fundamentals held in Seattle at the University of Washington was extremely successful according to Short Course Chairman, Roy Sawhill. Many compliments as

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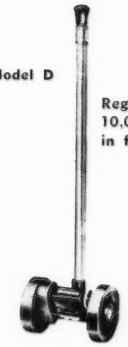
THE... *Shalda* MEASURE METER



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Special for the TRAFFIC ENGINEER: Graduated in either 10ths or 12ths

The Shalda Measure Meter has been put to practical use by traffic engineers all over the nation. Its simplicity and accuracy has proven tremendously valuable in traffic engineering and has been accepted as a useful and practical tool.

- Rust, dust, moisture resistant, sealed in mechanism.
- Light, weighs only 3 pounds.
- Extension handle to 40 inches.
- Finest precision counters.
- Trouble free, factory lubricated.
- Handy, portable—only 23 inches long.

FAST!! SIMPLE!! ACCURATE!!

Automatically adds or subtracts.
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Just walk it ahead—the precision computer clocks off feet and inches like an automobile speedometer...with equally simple reading. To subtract—just back it up.

At only $42.50 will pay for itself many times over.

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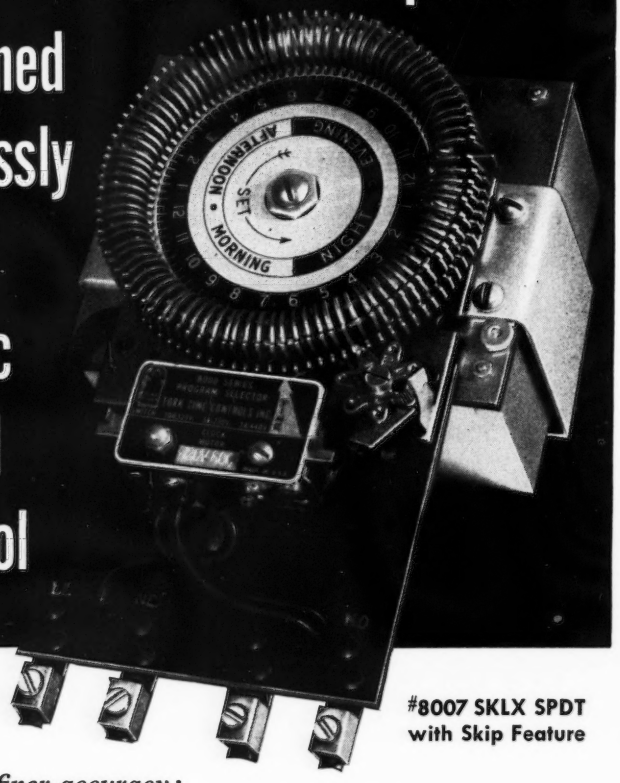
with reserve power

Designed Expressly For Traffic Signal Control



#8007 SKLX SPDT with Skip Feature

Gives you finer accuracy:

- 96 tabs on 24 hour dial permit 15-minute switching changes.
- Tabs easily tilted in or out by hand.
- 1 to 48 operations a day—15-minute minimum setting.
- Switch position stays the same when adjacent tabs are set alike.
- No conventional ON-OFF trippers to slide around the dial.

Gives you these EXCLUSIVE safety features:

- Keeps time for more than 20 hours after power failure.
- Reserve Spring rewinds electrically 10 times faster than used.
- Reserve spring is automatically "exercised" each day — no chance of locked up spring failing to take over when needed.

Here's the safest, most accurate time switch made for traffic signal control. Enthusiastically acclaimed and specified by those who have seen and tested. it. WRITE NOW TO DEPT. T-1 FOR FULL DETAILS.

TORK CLOCK

TORK TIME CONTROLS, INC.
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In Canada: DOMINION ELECTRIC MANUFACTURING CO., LTD., TORONTO

well as requests for additional courses have been received. Fifty-eight students received certificates.

Remember WesternITES and friends of same, be in Seattle on July 29, 30, and 31, this year, for the best Western Section Meeting technical and non-technical-wise you have ever seen.

On January 15th, the bi-monthly Washington Area Meeting was held in Tacoma. Among the guests were Gilbert M. Schuster, Director of Public Works for the City of Tacoma, and three graduate students from the University of Washington. Bob Dunn, member of the Technical Council, reported on the meeting held at Washington, D. C., Professor Ed Horwood reported on the Highway Research Board Meeting. Our first official technical session was held with Tom McLeod as Chairman. Bob Dunn presented a report on the Seattle Freeway Network Analysis Study. Paul Hooper of the Highway Planning Division reported on the "Use of Radar Detectors for Traffic Counting." John Strombom, also of the Highway Planning Division, reported on "Fuel Consumption on Freeways and By-Pass Routes."

The next meeting will be held on March 18th in Tacoma.

Arizona-New Mexico Area

In the City of Phoenix, another battle is on between the Traffic Engineering Division and the businessmen on Central Avenue. The City is combining with the County to install another mile of median islands and eliminating some angle parking. This is meeting with hot protest from the merchants, and Chuck Haley says this is the worst "scorching" he has run up against so far.

The Grant-Lincoln Trafficway in the City of Phoenix is now open for traffic. This section of arterial street two miles in length was constructed for use principally as a truck route. Many other streets in Phoenix need widening and improving, and the City advises that this program should get underway within the next year.

The tourist traffic in Phoenix is tremendous this year. Tourist traffic increases each year, but the increase during this season is quite remarkable. For example, on Central Avenue an all time high for ADT occurred last December 12th when 43,463 cars passed one check point. Previous to that time, a maximum high of 38,000 was registered last November 25th. During the 1957-1958 winter season the maximum volume was even less.

The State Highway Department is doing some experimental work on analyzing accidents using the Poisson distribution and checking the reflectorization quality of signs with a recently purchased brightness meter. Any comments from members of ITE concerning these two subjects would be appreciated.

The Arizona-New Mexico Area is planning another area meeting sometime in April. The exact date and location have not been established. The meeting will be held in Arizona.

San Diego Area

A paper, "Travel Time—An Effective Measurement of Congestion and Level of Service," by Ed Hall and Steve George, was presented at the Highway Research Board in Washington. Steve has supervised these travel studies on over 360 miles of streets and highways in the metropolitan area.

Ed Hall also attended the formation meeting of the National Committee on Urban Transportation "Committee to Develop the Transportation Plan" held in conjunction with the Highway Research Board.

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The unequalled readability of Stimsonite cutout letters, day or night, in all kinds of weather, has been proved by years of service. The wide range of alphabets offered by Stimsonite is unequalled, too. For your signing needs, you can choose from over 1000 different letters and accessories—ranging from 4 inches to 30 inches in height—capitals or upper and lower case.

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TENNANT Traffic Line Eraser shaves off paint in a single pass.

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Now you can remove old traffic markings *quickly* . . . permanently . . . and at *low cost.*

The TENNANT Traffic Line Eraser's steel cutters shave off painted lines *in one operation* . . . without damage to concrete surface underneath.

In fact, tests show new markings can be expected to last *up to 4 times* longer . . . because the Traffic Line Eraser removes oxidized concrete scale. Assures a firm bond for new paint; helps reduce flaking.

The TENNANT Eraser works on either concrete or asphalt surfaces.

- Usually removes 4 to 10 feet of markings per minute.
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TENNANT

TRAFFIC LINE ERASER

SPECIALIZED MAINTENANCE EQUIPMENT

Keith Gilbert is completing the calculation of auto-truck origins for the metropolitan area with a population of 2.5 and 2.0 million. These calculations are based on the City and County Planning Department estimates of population and land use.

Sacramento Area

Rudy Israel gave a talk at the December Sacramento ITE Area Meeting on the progress of the California Division of Highways' compliance to the new Interstate Sign Standards. He highlighted some of the requirements and how they differed from current practices.

Other items at the December meeting were: D. J. Faustman, member of the WITE Membership Committee, pointed out that there were many qualified personnel of the Division of Highways who are not members of ITE. Discussion followed as to how to convince these persons of the advantages of belonging to ITE. This point is undoubtedly applicable to many large organizations. (Local Section will appreciate any suggestions). Dee McKenzie, Sacramento County Traffic Engineer, requested that local members start to thinking about how they would stripe a five-lane roadway through a commercially built-up area and be prepared to discuss it at the next meeting.

A weekly evening class in traffic engineering was conducted this past fall by the University of California Extension Service at Sacramento State College. Dr. D. J. Faustman was the professor. Guest lecturers included Roy Mathews and Lee D. Kies.

Charles Zell returned from his European vacation and as soon as he has his colored slides ready, the section plans to have a social affair and hear all about Charles' exploits.

Max Glass and Lee Kies finally were able to get convention photos off to those WITE members who attended last June. To prove it, we have a thank you letter from Jack Bruce in Denver. (Thanks from us too—Ed.)

The January 5, 1959 meeting of the Sacramento Area was called to order by Chairman George Hill, there being twelve members and two guests in attendance. The two guests were Bill Shaefer and Ed Graham, both of whom are employees in the Traffic Engineering Section of the California Division of Highways. Charles Zell reported an invitational letter to prospective members was being prepared. Barney Switzer commented on the future of the Annual Governor's Safety Conference. Consensus was that it is too early to know what the new Governor's intentions are going to be regarding the Conference.

The balance of the meeting was devoted to a discussion led by Dee McKenzie on suggested ways of striping a five-lane section of pavement through a commercially built up area. The discussion was most lively with all members participating. It was learned that a five-lane section is soon to be installed in Modesto and will, if no changes are made, incorporate short medial islands at the intersections with the balance of the fifth (middle) lane defined by broken double-center, with an occasional single diagonal line.

The February meeting will feature a talk by Charles E. Zell on "Traffic Engineering in Europe." Zell has been recently elected president of the Sacramento Area Planning Association. This is a citizens group supporting good planning (highways, land use, recreation, governmental structure). Charles also received an associate membership in ASCE.

Mel West is to present a paper at the forthcoming Regional ASCE meeting in Los Angeles in February.

On January 15th a party was given in Stockton honoring Richard A. Wilson on his retirement. Dick was District Traffic Engineer for District X of the California Division of Highways. Happy Days, Dick! Don't forget to visit us.

On January 14th a public hearing was held at the Sacramento Junior College on proposed routes of an East-West Freeway through Sacramento. You travelers, cheer up. It will only be another five to ten years and it will be easy to get into and through Sacramento—the bottleneck of US 99 and US 40.

D. Jackson Faustman, recently was elected to membership in the University of California Chapter of Signa Xi, a scientific research society. Jack also has become a full member in ASCE. Congratulations, Jack!

The axiom "Those who know to learn, know enough" was followed by six members of the Local Section recently. Maynard Glass, Rudy Israel, Dee McKenzie, Charles Zell, Barney Switzer, and Lee Kies were among some 100 persons attending a University of California Extension Service class on "Administration and Supervision for Highway Personnel." This course is an example of the type of courses arranged by Bob Glenn in his job of extension service with the University. Bob was there on the job.

Los Angeles Area

Having been operating under the premises that, "No news is good news," "What you don't know won't hurt you," "Absence makes the heart grow fonder," "Its nice to be missed," and "Better late than early,"

60,000 cars per day moved thru Dallas intersection

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Traffic conditions at the intersection of Northwest Highway and Preston Road in Dallas, Texas indicated the necessity of volume-density signal control. An average daily volume of 60,000 cars, sharp peaks, heavy left turns and intermittent pedestrian requirements all contributed to intensify the problem.

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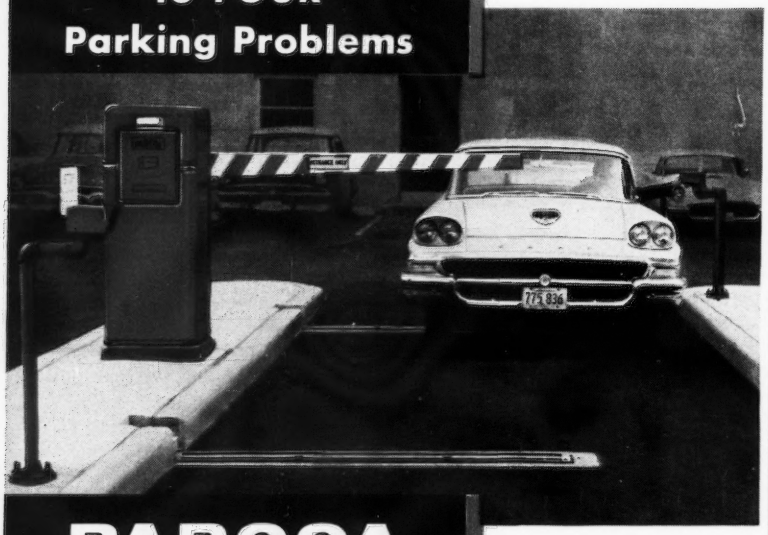

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for cars parking on monthly or reserved basis.

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the Los Angeles Area is surfacing and breaking silence to bring to the world the following hot scoop:

We are happy to welcome as a sustaining organization the J. E. Bauer Company, together with Jack Bauer and Ray Meggison.

Also extremely welcome are four new members—three Jacks, namely Eckhardt and Holm of the California Division of Highways, Williams of the City of Glendale, and one joker, Karl Jagenburg, of the City of Los Angeles.

Our workshop, which consists of informal discussions preceding regular business meetings, has kicked around the following subjects: "Use of Green Arrow in Conjunction with Other Indications," "Traffic Signs, Their History and Future," and "Pavement Markings Uniformity." The problems connected with left-turn prohibitions is the subject for the upcoming February meeting.

Among those who have entertained and educated us have been Gran Parmelee, who summarized the events of the National Convention at Miami; the President of the La Mirada Toastmasters' Club, who told us from his "average driver" viewpoint what was wrong with traffic etngineers and made us like it; John Broadbent of Alcoa with a new movie entitled "Alcoa Aluminum in Illumination"; Al Pryor, Edison Company, who described for us the part that highway lighting can take in civic betterment; and Stanley Lanham, member ITE and Director of Planning for the Metropolitan Transit Authority, who explained to the membership the powers and limitations of the M. T. A.

George Villegas, formerly with the Automobile Club of Southern California, took over as Traffic Engineer of the City of Anaheim on January 19, 1959.

Hal Durham has settled into the harness and is doing an excellent job as Traffic Engineer of the City of Downey.

Vern Havenner's many friends were sorry to learn of his premature retirement from the County Road Department because of ill health.

Harold Marks has promised to attempt to produce another program similar to the "Great Debate," which was so well received when presented at a Los Angeles Area Meeting two years ago.

We are happy to report that Sam Kennedy's and "Blick" Blickensderfer's retirements do not appear to have lessened their great interest in Institute affairs.

We are sorry for Sacramento's loss, but glad to welcome to the Los Angeles Area Max Gilliss, new Road Commissioner of the Los Angeles County Road Department.

The City of Los Angeles has lost one member to our new state. Steward Knapp, formerly with Signal Division, has taken the position of Assistant Traffic Engineer with the City of Anchorage, Alaska.

Jackson DeMuth, formerly Associate Traffic Engineer with the Los Angeles City Department of Traffic, is now employed by Portable Signal Corporation.

Inter-Mountain Area

The Wyoming Highway Department has moved into its new building on the northwest edge of Cheyenne. It is located directly opposite an interchange on Interstate Route 25, making it quite convenient for anyone to find the building. Two weeks after the Department moved into its new headquarters, they opened an 18-mile section of Interstate roadway. In summarizing the general comments received during the first hectic week, Bob O'Connell says that they are very much in need of a Formal Driver Education Program. However, driving habits have improved slightly—evidently there is

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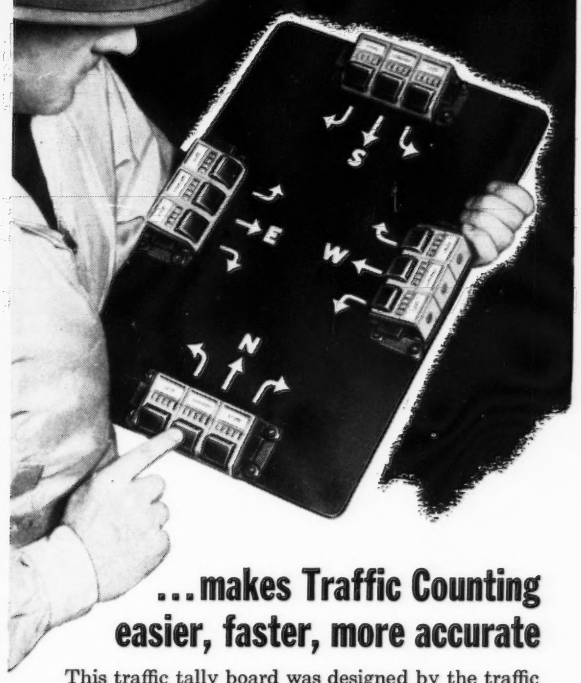
* Veeder-Root does not make or supply this or any other type of mounting board for the Vary-Tally Counter.



...makes Traffic Counting easier, faster, more accurate

This traffic tally board was designed by the traffic engineers of a large eastern city, and produced by them for their own use.* 3 Vary-Tallies on each side of the board count and classify all traffic entering intersections from any direction. Positive action of the large finger-keys makes it easy for operator to keep up with heaviest traffic flow.

Veeder-Root makes the Vary-Tally in any combination up to 6 banks high and 12 units wide . . . also in single units. All counters in one bank are reset by one turn of one knob. See how Vary-Tallies can help in *your* traffic-control problems. *Write.*

VEEDER-ROOT also makes Hand Tallies (single) and counters for Parking Meters, Metering Devices, Wheeled Measuring Devices.

"The Name that Counts"

VEEDER-ROOT INC.

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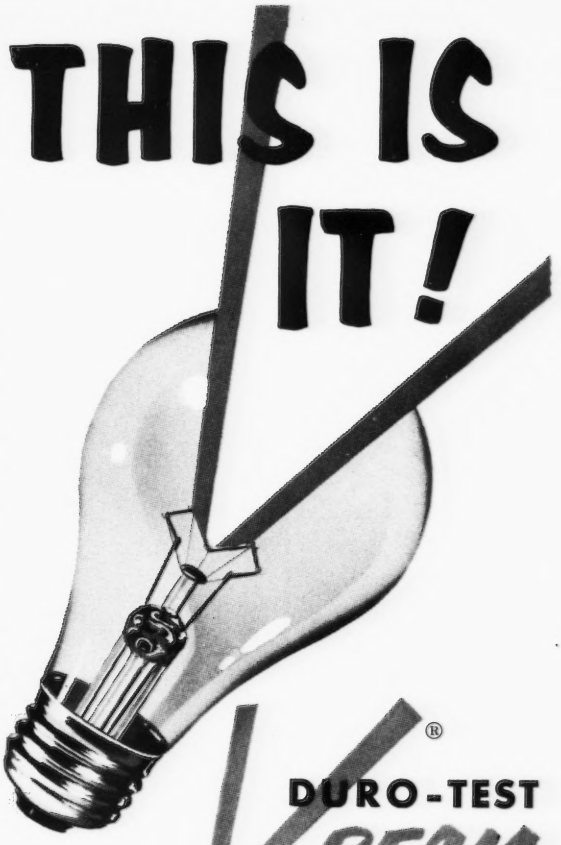
TEL. JACKSON 7-7201

THIS IS IT!



DURO-TEST V-BEAM®

AMERICA'S FINEST TRAFFIC SIGNAL LAMP

This is the traffic signal lamp with the exclusive filament construction that V-beams 28% more light toward oncoming drivers than ITE specifications require!

This is the lamp that delivers 8,000 hours of bright life in its 67 watt size...5,000 hours in its 40, 60, 100, 150 watt sizes. The 150 watt Super V-Beam fits either 8" or 12" signals. Super-safety hint; use for super-visibility in red lens sections.

5000 and 8000 HOURS

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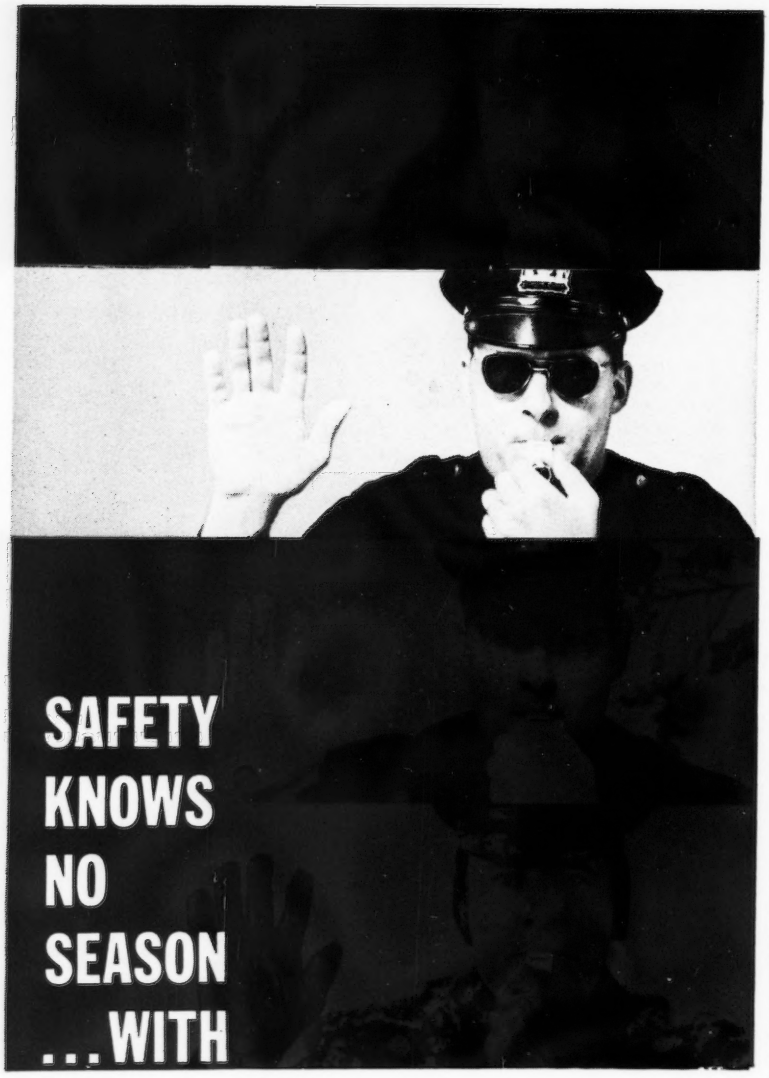

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This is what makes thermoplastic PERMA-LINE different from old fashioned marking methods: *It's there when you need it most,* whatever the season.

For long lines or crosswalks, in any climate, PERMA-LINE is unsurpassed for high visibility, durability and *guaranteed* safety protection.

PERMA-LINE applies with amazing speed. It dries almost instantly; without disrupting traffic. That's why modern, all-season PERMA-LINE—and only PERMA-LINE—can meet the strict standards of safety demanded by the new Interstate Highway System.

For economy and permanence, Traffic Engineers know: "Whatever the season, if there is a reason for *any* safety marking, there is a better reason for PERMA-LINE."

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hope for Wyoming's drivers. The Wyoming Yield-Right-of-Way law reads that a driver may drive past the sign at a speed not to exceed 10 miles per hour. With these "YIELD" signs located as recommended by the AASHO standard, we defeat the purpose of an acceleration lane because we limit the driver's speed past this sign to 10 miles per hour. Denver has noted this same difficulty and Bob wonders if National should not reconsider the use of the "YIELD" sign on approach ramps. (Note: Denver is planning to correct this situation by removing the 10 MPH stipulation in its Municipal Traffic Code and revise the section to read similar to that in the State of Washington).

Our roving reporter, Jack Shockey, reports that Maurice RiChey is currently enjoying a three-weeks trip to Europe comparing some of the European ski runs to those in Montana. Although details are lacking, we understand that Ray Halverson has resigned his position as Traffic Engineer for Utah and has joined the staff of a Minnesota Mining and Manufacturing Company. Also from Utah, we understand that Jim Challis now has a new assistant in his department.

The Traffic Operations Section of the Colorado Department of Highways has tabulated the past year's work in connection with the "Annual Inventory of Traffic Safety Activities." Four major accomplishments of the section are as follows: (1) Four Interstate signing plans have been prepared, contracts awarded, and the jobs are either completed or under construction. These four signing contracts cover approximately thirty (30) miles. (2) In addition to the Interstate signing, complete traffic controls were added to seventy-eight (78) different construction plans. These plans included rural and urban highway construction at various locations. (3) Speed zoning was developed for 1,664 miles of highways. This includes 1,107 miles of new speed zoning and 557 miles of restudied speed zoning. Colorado now has 6,914 miles of the State Highway System speed zoned. (4) Approximately 194 "High Accident Frequency" and "Recurrent Accident" locations throughout the state were studied. These problem locations, including both individual intersections and highway sections of various lengths, were analyzed and the reports were forwarded to the Field Engineering Districts for action.

Colorado is celebrating it's Centennial this year, and as a part of the celebration, the Downtown Denver Merchants are planning to construct false fronts for many of the downtown business establishments, which will depict the "Wild West" of one hundred years ago. This has posed a new problem for Jack Bruce. Now, instead of worrying about the design of "NO PARKING" signs, he is desperately trying to figure out a new design for hitching posts.

HOW MANY SIGNS WILL IT TAKE?

. . . A rough estimate would be that Ohio's 1,500-mile Interstate freeway system will need at each traffic interchange area:

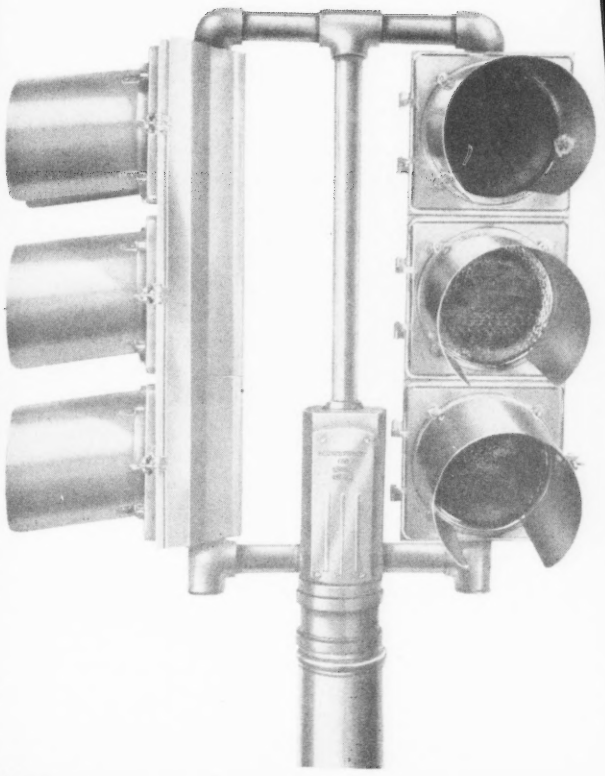
8 route markers.
4 directional signs.
4 informational signs.
6 warning and regulatory signs.

—

22 markers and signs—at each and every interchange.

MARBELITE 1058 STANDARD 8" SIGNALS

OUTSTANDING DESIGN
SUPERIOR LIGHT OUTPUT
MINIMUM MAINTENANCE



Marbelite adjustable signals have received the highest possible compliment possible — IMITATION BY THE INDUSTRY.

Marbelite has featured unit construction without tie rods and/or end plates, fixed focus sockets and light weight design for many years.

Signals being offered in the traffic field today are now adding these long time Marbelite features. You can count on Marbelite remaining the leader for years to come.

Marbelite features

- ✓ Sectional construction using non-corrosive hardware and fittings.
- ✓ Light in weight especially when used with Marbelite aluminum hollow brackets.
- ✓ Exceeds I. T. E. specifications for design and light output.*
- ✓ Clean cut design and pleasing appearance.
- ✓ Glass or Alzak reflectors interchangeable.
- ✓ Corrosion resistant fittings throughout.
- ✓ All neoprene gaskets supplied if requested.

12 inch signals also available

THE MARBELITE CO., Inc.

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*Technical Report Number 1, Revised 1958
ASA D-10.1 - 1958

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YOUNG ENGINEER

PAST PRESIDENT'S AWARD

This recognition can be yours

Each year the Past President's Award is made to the young engineer (under 35 years of age) whose paper is selected as the most significant contribution to traffic engineering.

This Award is formal recognition of an outstanding accomplishment.

When YOUR Award-Winning Paper is published in *Traffic Engineering* magazine and other professional journals, it means YOU have something important to say to all of us.

To qualify as a candidate for the Past President's Award, you

- must be a Junior or Associate Member of the Institute of Traffic Engineers
- must be under 35 years of age (as of July 14, 1959)
- must have conducted some independent and original technical study or research and must furnish evidence of primary responsibility for this activity. It is recognized that such studies or researches by young engineers may be of rather limited extent.

Your Paper must be

- submitted (typewritten, double-spaced, an original *and* five copies) by July 14, 1959
- previously unpublished or published since July, 1956
- a minimum of 1,500 words and a maximum of 5,000 words
- limited to one entry
- submitted to David M. Baldwin, Executive Secretary, Institute of Traffic Engineers, 2029 K Street, N.W., Washington 6, D.C.

Your Paper may be

- on any subject, study, or experience of your own selection providing it pertains to the advancement of traffic engineering or related fields and is based on your personal efforts and project responsibility. It should contain a summary of conclusions and any appropriate recommendations.

1959 *The Award-Winning Paper will be presented before the Annual Meeting of the Institute of Traffic Engineers at New York City in September, 1959.*

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MEMBERSHIP APPLICATIONS

APPLICATIONS FOR TRANSFER

GALIOTO, Anthony J.
Traffic Engineer, Port of New York Authority, 111 Eighth Avenue, New York 11, New York. January 26, 1959 for ASSOCIATE grade.

KUDLICK, Walter
Engineering Specialist, Edwards & Kelcey, 3 William Street, Newark, New Jersey. January 22, 1959 for ASSOCIATE grade.

VOORHEES, Alan M.
Traffic Planning Engineer Automotive Safety Foundation, 200 Ring Building, Washington 6, D.C. January 21, 1959 for MEMBER grade.

NEW APPLICATIONS

ADAMS, Clinton F.
Traffic Engineer I, City, 147 Fountain Street, Providence, Rhode Island. January 12, 1959 for ASSOCIATE grade.

BLACKWELL, Frank H.
Chief Engineer, Richmond-Petersburg Turnpike Authority, P. O. Box 1-R, Richmond 2, Virginia. January 30, 1959 for ASSOCIATE grade.

BLALOCK, Thomas M.
Traffic Engineer, City, 456 West Olive Avenue, Sunnyvale, California. February 9, 1959 for JUNIOR grade.

BRABANSKI, Frederick W.
Associate Signal Engineer, Department of Highways & Traffic, District Building, Washington 4, D.C. January 16, 1959 for ASSOCIATE grade.

CHEATHAM, Earl F.
Traffic Engineer, Orange County Highway Department, Courthouse Annex, Santa Ana, California. February 2, 1959 for ASSOCIATE grade.

GARRETSON, Forrest D.
Manager, Highway Division, Swindell-Dressler Corporation, P.O. Box 1888, Pittsburgh 30, Pennsylvania. February 9, 1959 for ASSOCIATE grade.

GERTEL, Morton
Senior Highway Analyst, N. J. State Highway Department, 1035 Parkway Avenue, Trenton, New Jersey. January 16, 1959 for ASSOCIATE grade.

HARASZTI, Leslie Z.
Design Engineer, Metropolitan Toronto Planning Board, 133 Richmond Street West, Toronto, Ontario, Canada. January 30, 1959 for ASSOCIATE grade.

JONES, John E.
Senior Highway Analyst, N. J. State Highway Department, 1035 Parkway Avenue, Trenton, New Jersey. January 14, 1959 for ASSOCIATE grade.

(Continued on page 60)

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To make your Budget for Reflectorized Signs go Farther . . .

NEW 831 IMPROVED

GLASS BEADS

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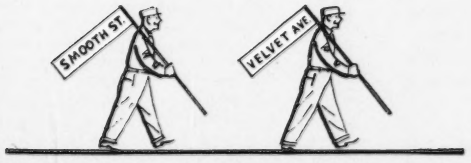
Now, thanks to better research and engineering, your signs can have the ultimate in long range reflectivity, plus day and night message legibility never before obtainable at any price. Applied at economical cost and "permanized" with Flex-O-Lite's amazing "STORMCOTE", protective covering agent, you get new highs in weather, water, dirt and wear resistance, plus *nearly 90° angularity!* Put the new Flex-O-Lite 831 Reflective Sign System to the test in your own shop. Details in our new bulletin. Write today.



Available in "extra-fine" grade for Street Name Signs and License Plates. Affords extra velvet-smooth finish for added dirt and wear resistance, and greater economy.

2

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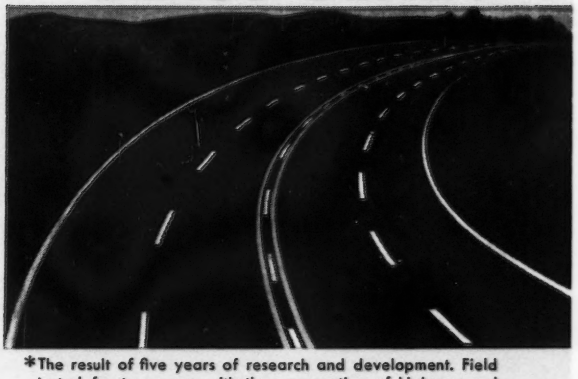

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Over 1000 Winko-matic Model 1 Pedestrian Signals in use in New York City and thousands in use all over the country, including Hawaii and Canada.

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NEW CERAMIC DONT AND WALK Lens prevents silk screened legend from peeling. Guaranteed for life. Standard signal equipped with two holes top and bottom for any type pipe mounting.

Other combination colors available such as blue and orange, other messages available such as WALK-WAIT. CAN ALSO BE USED FOR LANE CONTROL with USE and DONT USE. Model 1 above is 24" x 18". Model 3 measures 16" x 14" and Model CD-10 is 16" x 14". Neon formed letters can be supplied upon request. Cat. No. P-103 and M-10 for mounting brackets.

Removable sheet aluminum sun visor for quick replacement. All electrical parts in separate rear compartment serviced from the rear. Neon tubing jackmounted in front section.

Not affected by climate changes, neoprene molded gasket surrounds each lens and case. Heater and thermostat supplied upon request. Walk and Dont Walk each on separate circuit to allow for fail safe system and flashing clearance interval period.

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Cable Address: WINKO — LORAIN, OHIO, U. S. A.

Positions Available

WICHITA, KANSAS

Position: Associate Traffic Engineer.

Requirements: Considerable experience in field of traffic engineering, following graduation from an accredited engineering college or university with specialization in traffic engineering. Applicants must be eligible to obtain Kansas registration as a professional engineer. Engineering graduates without experience may be considered at a lower salary range.

Salary: $485 to $590 per month.

Apply: Applicants should obtain and submit formal applications to the City of Wichita, Room 407 City Building, Wichita, Kansas.

UTAH STATE ROAD COMMISSION

Position: Traffic Engineer.

Requirements: Graduation from recognized school of engineering. Graduate work in traffic engineering desirable. PE in Utah or ability to qualify for such registration. Approximately ten years experience as traffic engineer or designer, with minimum of five years as traffic engineer.

Salary: $700-$850 per month depending on experience.

Apply: Director of Highways, Utah State Road Commission, State Capitol Building, Salt Lake City, Utah.

PITTSBURGH, PENNSYLVANIA

Position: Chief Engineer, Public Parking Authority of Pittsburgh — Responsible for co-ordination and operation of an expanding system of off-street parking garages and lots. Challenging opportunity with one of the public agencies actively engaged in Pitttsburgh's renaissance program. Position eventually will lead to the dual post of Assistant Direcor and Chief Engineer.

Requirements: Graduate Civil Engineer with minimum of five years experience, preferably in design and/or construction. Traffic engineering training or equivalent experience desired. Registration as P.E. or ability to qualify for registration will be given special consideration.

Salary Range: $7,200 to $8,500 per year, depending on education, experience and personal aptitude for the Authority's program.

Apply: Mr. Merritt A. Neale, Executive Director, Public Parking Authority of Pittsburgh, 1208 Civic Building, 200 Ross Street, Pittsburgh 19, Pennsylvania.

EUGENE, OREGON

Position: City Traffic Engineer.

Requirements: Traffic engineer with two years experience in traffic engineering and control to plan, direct and supervise the activities of the Traffic Engineering Division.

Salary: $5544 to $6504 annually.

Apply: Submit application listing references, experience and education to Mr. Robert Finlayson, City Manager, Eugene, Ore.

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- Success of your proposed development is dependent upon public acceptance of the parking control equipment installed.

- Insure your program's success by using today's most dependable parking control products . . . . DUNCAN-MILLER meters.

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- Investigate DUNCAN-MILLER'S highest net revenue method of operation today.

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The small size ITE lapel button, reproduced here, approximate size and color. 1/10 14 carat gold plate with screw back.

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The official insignia — a reproduction of the ITE seal — as a lapel or shirt pocket pin with safety catch is shown actual size in cut at left.

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Washington 6, D.C.

MEMBERSHIP APPLICATIONS

(Continued from page 56)

KHANNA, Tejbir S.
Assistant Director I/C Traffic Engineering, Central Roads Research Institute, New Delhi 20, India. January 12, 1959 for MEMBER grade.

KLINCK, John H., Jr.
City Engineer, Traffic Engineer, 824 Newark Street, West Palm Beach, Florida. February 9, 1959 for ASSOCIATE grade.

LABIDAS, Villy
Assistant Operations Engineer, City, City Hall Annex, Philadelphia 7, Pennsylvania. February 9, 1959 for JUNIOR grade.

LEE, Robert E.
Engineering Assistant, County Roads Board of Victoria, Exhibition Building, Carlton N.3, Victoria, Australia. January 16, 1959 for ASSOCIATE grade.

McCOMBS, Royce G.
Assistant Traffic Engineer, City, Traffic Engineering Department, Greensboro, North Carolina. February 3, 1959 for JUNIOR grade.

SAGI, George
Junior Engineer, Signals Department, City, 180 Rupert Avenue, Winnipeg, Manitoba, Canada. February 9, 1959 for JUNIOR grade.

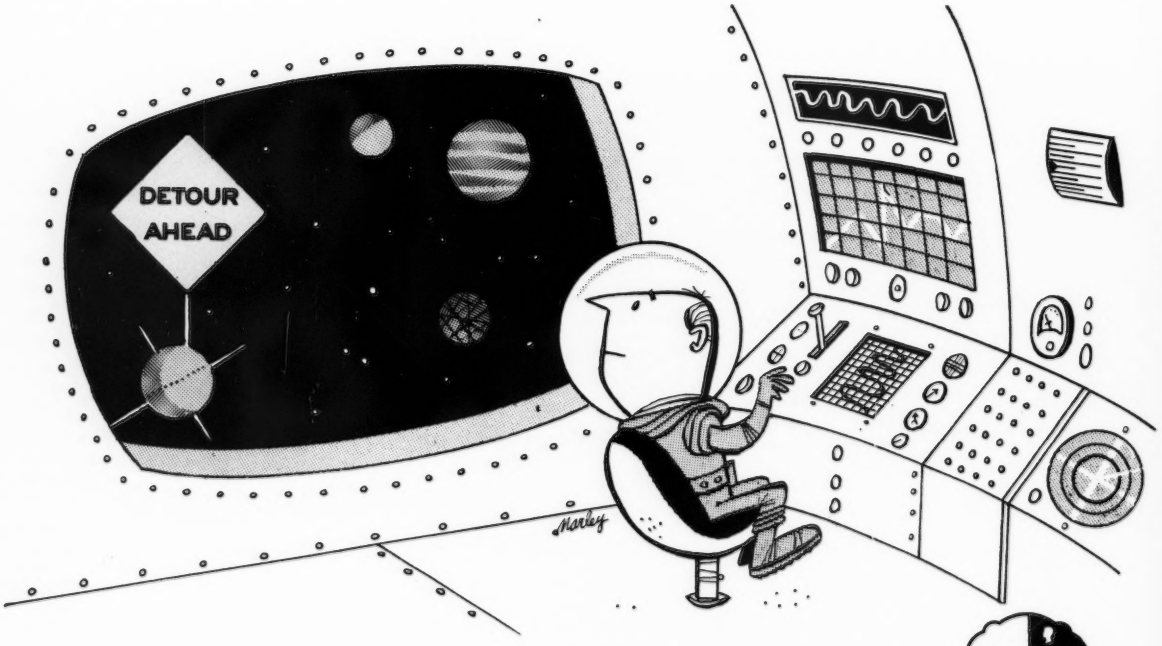
SCHUMACHER, Earl W.
Assistant Traffic Planning Engineer, Metropolitan Dade County Department of Traffic & Transportation, 1357 N.W. 11th Street, Miami, Florida. February 5, 1959 for JUNIOR grade.

SEIBOTH, Frank L.
Senior Traffic Engineer, N. J. State Highway Department, 1035 Parkway Avenue, Trenton, New Jersey. February 3, 1959 for ASSOCIATE grade.

SORANNO, Vito V.
Planning Technician, Port of New York Authority, 111 Eighth Avenue, New York 11, New York. January 16, 1959 for JUNIOR grade.

TOBERMAN, Norman J.
Village Engineer, 107 West Davis Street, Arlington Heights, Illinois. January 26, 1959 for JUNIOR grade.

WONG, Oliver D. K.
Traffic Engineer, Territorial Highway Department, P. O. Box 162, Honolulu, Hawaii. January 21, 1959 for JUNIOR grade.



LONGER LASTING CAMEO SIGNS ARE EVERYWHERE!

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Genuine PORCELAIN ON METAL LIFETIME FINISH

New Warning Sign for No Passing Zone

An idea for warning drivers they are approaching a no-passing zone is being tried on an experimental basis along U.S. Highway 30, from the Nebraska border to Rawlins, Wyo.

The device consists of a post with parallel strips of reflective tape, placed on the left side of the road at the beginning of each no-passing zone. The idea, according to a Wyoming highway engineer, came from a group of Greyhound drivers based at Cheyenne.

The bus drivers said that often at night an automobile driver attempts to pass a larger, slower vehicle and can't see the painted no-pass stripes on the highway soon enough. With the reflective tape on the left side, the driver could see it, as he pulls his car out, when the headlight beams hit the posts.

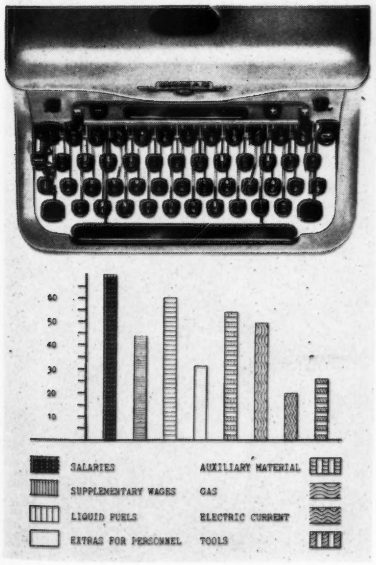
—From July 1958 issue of Fleet Owner Magazine

STRICTLY BUSINESS

(Continued from page 47)

Chart Typewriter Offers Interesting Possibilities For Engineers

A completely new development in typewriters is the Chart-Typer, enabling any typist to type the most complex chart material. The keyboard has a normal upper case alphabet and



figures. Instead of lower case letters the machine has 27 different chart symbols. All chart symbols are in shift position so that no shifting is required when either "chart-typing" or "regular typing." A simple-to-adjust attachment permits the typing of charts on any kind of chart paper, accurately scaled and aligned at all times. The operation of the Chart-Typer is actually easier than that of a standard typewriter. With a simple carbon ribbon attachment, the material typed on this machine is ready for offset printing production.

Priced moderately above standard typewriters, the Chart-Typer made by Siemag Feinmechanische Werke GM BH in West Germany is exclusively distributed by Continental Office Machines, Inc., 500 Fifth Avenue, New York 36, N. Y. Complete literature is available on request from Continental Office Machines, Inc.

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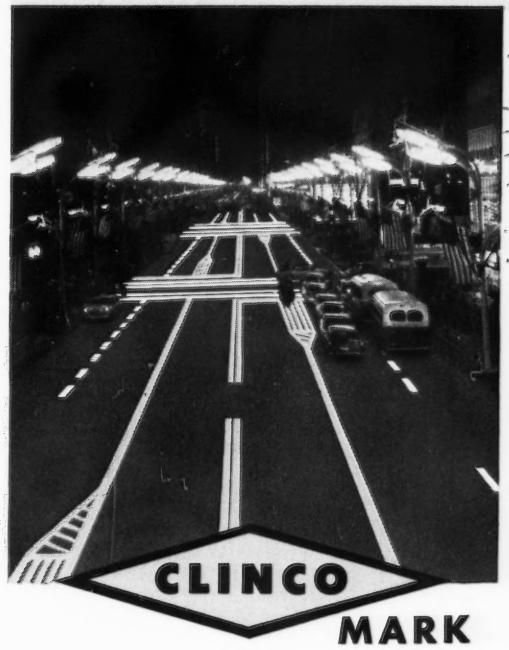

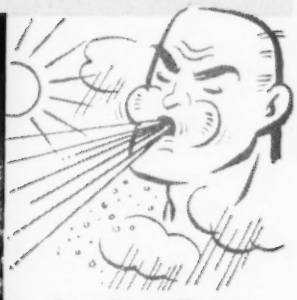

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North Carolina Expands Its GE Radio System

North Carolina's Highway Commission is enlarging its statewide two-way radio system with 180 transistor-powered General Electric mobile communication units.

The new installation represents the second phase of the Highway Commission's communications expansion program, designed to enable the Commission to meet storm emergencies flexi-

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bly and to increase administrative efficiency in routine day-to-day operations.

While radio's effectiveness in hurricane situations led to plans for its increased use by road crews throughout the state, the Highway Department also cited administrative advantages of vehicular communication as a major reason for the present expansion.

"Several thousand dollars is saved annually," the Commission reports, "in *each* division where this equipment has been installed and operated."

Approximately 170 G-E mobile radio units went into service earlier this year in the eastern and western sections of the state. The latest equipment is designated for the central portion. When the system is complete, the number of radio-equipped vehicles will total nearly 500.

The system includes 85 base stations, used primarily at dispatch points and for remote control purposes. Voice communication from these points gives the department statewide coverage, permitting highway crews to move into action instantly when necessary.

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